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A DESCRIPTIVE AND ILLUSTRATED

CATALOGUE

OF THE

CALCULI

AND OTHER

ANIMAL CONCRETIONS

CONTAINED IN

THE MUSEUM

OF

THE ROYAL COLLEGE OF SURGEONS IN LONDON.

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PREFACE.

THE present Volume contains a Descriptive and Illustrated Catalogue of the different kinds of solid bodies found in the various cavities of the animal body, and which are unconnected with the living textures. It is divided into three parts.

The first part comprehends Concretions occurring in the Urinary Organs, or parts immediately connected with them.

The second part comprises Concretions found in the Stomach, Intestines, or in any other of the organs subservient to digestion.

The third part comprehends Concretions derived from other sources not included in the former divisions, as those occasionally found in the Lachrymal Sac, the Veins, Bronchi, and Joints. Each part is divided into a Human, and a Comparative Series.

In the arrangement of the subdivisions of each part, the Calculi have been classed according to their chemical composition; those which are not from the Human subject having been previously distributed under the heads of Mammalia, Birds, Reptiles, and Fishes. To obviate any difficulty that might arise from the adoption of a merely chemical arrangement, a Table of the composition of the Concretions, arranged according to the animal from which they were taken, will be found in the introduction to each part.

Calculous concretions, although presenting considerable differences in their structure and composition, may be divided into two classes, accordingly as they are derived from one or the other of the two following sources: first, an excessive, or an altered and vitiated secretion; and secondly, substances introduced with the food, and retained

in the different parts of the alimentary canal. To the former class belong, not only the products of the true glandular organs, as the liver and kidney, but also those of the mucous and synovial surfaces.

Concretions derived from the true glandular organs usually consist of some of the more insoluble of the constituents of their natural secretion; or of the elementary principles, which it is the function of these organs to separate from the system, combined into some new form of organic matter. Of the former of these, we have instances in gall-stones, which consist for the most part of cholesterine, and of the colouring matter of the bile, and also in urinary calculi consisting of uric acid, and of urate of ammonia; which substances enter respectively into the composition of the healthy secretions from the liver and kidney, and are by far their least soluble constituents; while cystic oxide and oxalic acid furnish examples of the latter, those substances not existing in healthy urine, and making their appearance only in certain forms of disease. Concretions derived from any one of these sources invariably possess either a laminated, or a crystalline structure.

The origin of the concretions which form in mucous passages is much less certain than that of the concretions from true glandular structures; they rarely put on a laminated texture, and are almost invariably composed of phosphate with carbonate of lime, and usually contain mucus in a more or less altered state.

The most common, if not the only instance of solid masses formed by synovial membranes, is the chalk-stone (or *tophus anthriticus* of old writers) which occurs in persons affected with gout, and which consists of uric acid combined with soda. The same concretion is not unfrequently met with in the subcutaneous cellular tissue, and it is always a porous earthy-looking mass, devoid of any definite figure or structure.

Concretions of the second class, namely those which are to be traced

to substances introduced with the food, include the different varieties of Oriental and Occidental Bezoars or Ægagropiles. They have usually some foreign body (as a piece of wood or pebble) in their centre, around which the deposit has taken place. The greater number are composed of some of the more insoluble constituents of the food of the animal, which in some cases appears to have been dissolved in the first instance by the intestinal juices, and afterwards separated from them in the solid form, by a process of crystallization. In others, the particles of which they are composed have simply become aggregated around the foreign body in the form of thin consecutive layers.

Calculous concretions admit therefore of a natural division into two great classes, founded upon their mode of origin, namely, those which are the result of internal causes, the products of secretion; and secondly, those which are derived from without, and are wholly unconnected with the vital functions. An arrangement of these bodies having the above principle as its basis of classification, would, however, be founded upon much less certain, and less easily ascertained facts than that which has been adopted, and, although perhaps the most scientific, would not offer the same facilities for reference.

The greater part of this Collection was formed by Mr. Hunter, whose comprehensive genius embraced every subject that tended to enlarge the boundaries of Medicine and Surgery. Owing to the imperfect state of chemical knowledge at that period, Mr. Hunter attempted no further arrangement of these bodies, than by simply referring them to the different organs from which they were taken.

In 1809 a very important addition was made to the Collection by the purchase from the British Museum of the calculi formerly belonging to Sir Hans Sloane: these specimens are marked in the Catalogue as from the "British Museum." The Council have also purchased from private museums such specimens as were required to

render the Collection complete; calculi acquired in this manner are indicated in the Catalogue as follows: "*Mus. Liston,*" "*Mus. Taunton,*" &c.

The Council have also pleasure in acknowledging the large number of specimens, derived from donations, among which the most extensive are those by Sir W. Blizard, Sir E. Home, John Gunning and W. Lynn, Esqrs., and the Executors of William Long, Esq. A very beautiful specimen of the cystic oxide calculus presented by the Governors of St. Bartholomew's Hospital, and several small concretions of the same substance presented by Professor Brande, together with a portion of an uric oxide calculus given by Professor Marx, have rendered the Collection of the Human Urinary Calculi nearly complete.

A portion of this Collection was formerly examined by Professor Brande, who also published the results in the Philosophical Transactions for 1808. Within the last four years the entire Collection has undergone a complete revision, and the calculi have, for the first time, been arranged in a systematic order. Every specimen has undergone individual examination, as far as that could be done without injury to the calculus. The accomplishment of this undertaking was confided to Mr. Thomas Taylor, a Member of the College, whose fitness for the task is proved in the manner of its execution; and the Council have much gratification in acknowledging the value of his services. The composition of urinary calculi from the Human subject has been of late years so thoroughly investigated, that it was scarcely to be expected that much additional information would be gained by the examination of that part of the Collection. Some important facts, however, have been elicited, among which those which show the relative frequency of the various species of calculi, and the order of succession of their layers, are of great interest, as tending to throw light on the pathology of these diseases. It is also believed that the circumstance of uric acid calculi undergoing partial solution while in the bladder has been

satisfactorily demonstrated by the appearance of some of the specimens which have been examined. The deposit of the phosphates upon masses of margarate with oleate of lime, and that of uric acid upon a fragment of steel, are also worthy of especial notice. Calculi consisting almost entirely of urate of potass have been discovered among the urinary concretions from the lower animals, thus completing the list of the alkaline urates. A new species of Biliary calculus, composed of stearate of lime, has also been detected. To these may be added some new varieties of intestinal concretions, of the origin of which the Catalogue will contain a satisfactory account. The composition of these bodies, with the exception of the most common varieties, had previously received but little attention, and the sources from which they are derived had been involved in doubt and obscurity.

The Council have deemed it advisable to illustrate the various species, and the most remarkable of the calculi in the Museum, by coloured engravings. These, with the exception of the first plate executed on copper by Mr. Basire, have been faithfully delineated on zinc by Mr. Aldous; the latter metal having been found to be much better calculated to delineate the texture of calculous concretions than the former.

It has been thought expedient to commence each series by some introductory observations descriptive of the general appearance of the concretion, and of its varieties, its composition, relative frequency, and history, together with a brief account of the means by which its chemical composition may be ascertained. In these observations all theoretical opinions have been excluded, and only such statements have been advanced, as are based upon well-ascertained and generally admitted facts.

Series III.—Calculi of which the nucleus or primary deposit consists of Oxalate of Lime.

C.	Oxalate of Lime			33
C a.	Oxalate of lime.	Uric acid		21
C b.	Oxalate of lime.	Urate of ammonia		0
C c.	Oxalate of lime.	Earthy phosphates		28
C d.	Oxalate of lime.	Uric acid.	Urate of ammonia	0
C e.	Oxalate of lime.	Uric acid.	Oxalate of lime	1
C f.	Oxalate of lime.	Uric acid.	Earthy phosphates	8
C g.	Oxalate of lime.	Urate of ammonia.	Uric acid	0
C h.	Oxalate of lime.	Urate of ammonia.	Oxalate of lime	0
C i.	Oxalate of lime.	Urate of ammonia.	Earthy phosphates	0
C k.	Oxalate of lime succeeded by four or more layers			4

Series IV.—Calculi consisting of Cystic Oxide.

D. Cystic Oxide	3

Series V.—Calculi consisting of Xanthic Oxide.

E. Xanthic Oxide	1

Series VI.—Calculi consisting of Phosphate of Lime.

F. From the Prostate Gland	4

Series VII.—Calculi consisting of Phosphate of Magnesia and Ammonia.

G. Phosphate of Magnesia and Ammonia	4

Series VIII.—Calculi composed of Phosphate of Lime and Phosphate of Magnesia and Ammonia mixed in various proportions (Fusible calculus of Dr. Wollaston).

H. Mixed Phosphates	48
H a. Deposited on Foreign Bodies	14
H b. Calculi in which the Phosphates have been followed by some other deposit	1

Series IX.—Calculi consisting of Carbonate of Lime.

I. Carbonate of Lime	0

Total 649

The only deviation that has been made from the general order of arrangement, is in those calculi, in which the earthy phosphates, although not forming the primary deposit, have been succeeded by some other deposits. There is only one specimen of this description in the Museum, and it forms a sub-class of the Phosphates. (Vide H b 1.)

From the preceding Table it appears, that out of six hundred and forty-nine calculi,

Uric Acid forms the nucleus of	278, or nearly as	5 : 12;
Urate of Ammonia . .	201, . .	4 : 13;
Oxalate of Lime . .	95, . .	1 : $6\frac{3}{4}$.

The number of calculi which are homogeneous, or consist of the same substance throughout, is 315, being in the ratio to the whole number nearly as 1 : $2\frac{1}{18}$; of those composed of two layers, 210, or as 1 : $3\frac{1}{11}$; of three layers, 87, or as 1 : $7\frac{1}{2}$; and of those consisting of four or more layers, 18, or as 1 : 36.

The following Table illustrates the relative frequency of the several orders of succession of the different layers of the alternating calculi:—

		As a secondary deposit.	As a ternary deposit.
Uric Acid succeeds . .	Urate of Ammonia . .	36	2
	Oxalate of Lime . .	30	12
Urate of Ammonia succeeds	Uric Acid	25	5
	Oxalate of Lime . .	0	0
Oxalate of Lime succeeds .	Uric Acid	13	5
	Urate of Ammonia .	74	0
The Phosphates succeed .	Uric Acid	27	14
	Urate of Ammonia .	64	13
	Oxalate of Lime . .	28	36

From this Table we find that the uric-acid-diathesis succeeds that of urate of ammonia in the ratio to the whole number of calculi nearly as 1 : 17. That, on the contrary, the ratio in which urate of ammonia succeeds to uric acid is nearly as 1 : $21\frac{1}{2}$. Oxalate of lime is succeeded by uric acid in the proportion of 1 to $15\frac{1}{2}$, while uric acid, on the contrary, is succeeded by oxalate of lime in the ratio of 1 to 36.

The proportion in which oxalate of lime succeeds to a deposit of urate of ammonia is much more frequent, being as $1 : 8\frac{7}{9}$; while, on the contrary, there is no specimen in the Collection of urate of ammonia succeeding a deposit of oxalate of lime.

The Phosphates succeed to uric acid in the ratio nearly of 1 to 16; to urate of ammonia as $1 : 8\frac{3}{7}$; and to oxalate of lime as $1 : 10\frac{1}{7}$.

The accuracy of the *general* law laid down by Dr. Marcet, that the phosphatic diathesis is never succeeded by any other, is fully borne out by the examination of this Collection. There is no instance in which the Phosphates form the nucleus of a calculus, and only one in which they have been succeeded by oxalate of lime. (Vide H b 1, p. 131.)

The ratio which calculi consisting entirely of the Phosphates bear to the whole number is as $1 : 13\frac{1}{2}$, and whether occurring as a secondary or ternary deposit, they form the exterior of the calculi in the general proportion of 1 to every $3\frac{1}{2}$*.

* In the above calculations calculi consisting of four or more layers have not been included.

CONTENTS.

INTRODUCTION TO PART I.

A KNOWLEDGE of the origin and composition of urinary calculi is comparatively of recent date, and cannot be said to have existed previously to the year 1776, when the celebrated Swedish chemist Scheele led the way to all subsequent inquiries on this subject, by the discovery of Uric Acid.

What was however wanting in knowledge, was abundantly supplied by speculation; for if we consult the works of medicine previous to his time, we shall find them filled with conjectures as to the nature of these bodies; conjectures, which, however ingenious, were for the most part erroneous, generally absurd, and always founded on mere speculation. It would therefore be entirely useless, to describe, more than cursorily, the various opinions which have been entertained respecting them, from the days of Galen and Pliny to those of Paracelsus, Van Helmont, and even as late as Margraaf, who in 1775 investigated the action of fire upon urinary calculi, but without arriving at any correct conclusions as to their composition.

In the earlier times, the general opinion appears to have been that the calculi of the bladder were of an earthy nature, or consisted of inspissated mucus (*pituita* or *mucilago* *), although at that period none of these terms had any precise meaning attached to them. A later, and perhaps, in the absence of experiment, a more natural view of the subject, caused them to be regarded as similar in composition to the earth of bones. About the beginning of the 15th century, Paracelsus, in his first chapter, *De Morbis Tartareis* †, contends, that these bodies

* In the MS. Catalogue of the Calculi in the British Museum from the collection of Sir Hans Sloane, and which was transcribed by Mr. Clift, some uric acid calculi are stated to be "*mostly made of pituita*."

† Dr. Pearson states, that Basil Valentine first threw out the idea of the matter of calculus being allied to Tartar, Phil. Trans., 1798. Fourcroy attributes it to Van Helmont, which is certainly incorrect.—*Système des Connaissances Chimiques*.

have no analogy with stones, properly so called, and argues at great length, that the terms *calculus*, *arena*, *sabulum*, used by the older physicians, are to be understood only in a metaphorical sense. He appears to have had some idea, that they were composed of the effete and excrementitious materials of the food, or of the body, which were to be expelled from the system. To this matter he applied the name of Tartar; partly on account of its being deposited from the urine in a similar manner to the lees from wine, and partly on account of the agony it produces in the patient, which he compared to that of hell*. Tartar, according to the hypothesis of this most extraordinary philosopher, was the ultimate principle of all organic bodies, the origin and cause of nearly all diseases, giving rise to different maladies, accordingly as it was deposited in one or other of the organs of the body. He enumerates several species of Tartar. Thus there was one Tartar of the Stomach, another of the Liver, and a third of the Bladder ; to the latter he applied the specific names of Duelech and Adamita†. He also applied the term Tartar to all substances deposited from a solution in fluids.

Notwithstanding his general absurdity, Paracelsus appears, in many places, to have had clearer notions of the nature of urinary calculi than preceding authors. Thus, he distinctly asserts, that the components of all calculi are contained in the urine, and that gravel and calculus are composed of the same materials. His notion also with regard to the formation of these bodies is sufficiently intelligible, and he recommends the examination of the urine in calculous disorders, not by the customary inspection of the urine, but by chemical analysis.

Van Helmont, who flourished about fifty years afterwards, in his celebrated treatise *De Lithiasi*, advanced a step further. He maintained the opinion of Paracelsus, that urinary calculi were totally distinct from minerals, that they were deposited from the urine, and that they differed from gravel only in size; but he rejected as wholly visionary the idea that they bore any analogy to the lees of wine, or were formed out of *pituita* or *mucilago*, and restricts the term Duelech, imposed by Paracelsus, to the peculiar matter of calculus. In this

* *Aur. Philip. Theoph. Paracelsi Opera Omnia*, fol. edit. Geneva, 1658, pp. 290, 448.

† " Et Adamita est lapis propriè qui in vesica."

" Duelech lapis est spongiosus, et illi lapides cum summo periculo sunt, et maxime dolent."—*De Tartaro*, lib. 1. chap. i. p. 441.

treatise we also find probably the first attempt to determine the nature of a calculus by actual experiment. Van Helmont submitted, what appears to have been a uric acid calculus, to dry distillation, and gives a very excellent description of the effects of heat upon that concretion :—" Exsectum Duelech distillavi per se, nec quicquam elicui, præter spiritum fœtidum urinæ, et flavum crystallum, simulque oleum, quale ex desiccatâ urinâ trahitur. Quod autem in fundo mihi remansit, terra erat nigra, combusta, friabilis et insipida."—Cap. v. From this experiment he drew the conclusion, that urinary calculi were composed of earth and the spirit of urine*.

So crude, however, were the ideas entertained with regard to the formation of urinary calculi, even at a much later period, that in 1717, in the MS. Sloanian Catalogue, the tuberculated exterior of the mulberry calculus is explained, by supposing the urine to have been in a state of ebullition ; and even after the discovery of Scheele, so little was known of the mode of examining these substances, that it is recorded by Dr. Marcet, that Mr. Lane published some experiments on calculi in 1792, in which he had endeavoured to analyse them by exposing them merely to the heat of an assayer's furnace †.

Scheele's discovery in 1776 must be regarded as the first step towards an accurate knowledge of urinary calculi. That acute and laborious philosopher not only showed, that these bodies consist, for the most part, of a peculiar concrete acid, which was readily soluble in alkaline solutions, but described in the most accurate manner its leading properties. He also added the important facts, that this acid was contained in all human urine, and that it was the principal constituent of the lateritious sediment in febrile disorders. To this substance the name of Bezoardic acid was subsequently applied, which, on the revision of nomenclature of chemistry by the associated French chemists in 1787, was changed to that of Lithic acid. Dr. Pearson in 1798 published some experiments in the Philosophical Transactions, endeavouring to prove that it did not possess the characters of an acid, but those of an animal oxide, and proposed for it the name of uric oxide ; since which time, the terms *lithic* and *uric* have been used indifferently. It has been asserted by Fourcroy ‡, and the

* J. B. Van Helmont, *Opusc. Med. Inaudita*, 4to edit., Amsterdam.

† Essay on Calculous Disorders.

‡ *Annales du Muséum National d'Histoire Nat.* vol. i.

statement has been copied by Dr. Marcet and others, that Scheele fell into the error of generalizing too hastily, in asserting that all calculi were composed of this one substance. No such inference can, however, be fairly drawn from the words of Scheele. He simply states, that all the calculi examined by him consisted of the same materials; and it is most probable that they were all of the uric acid species. "Omnium calculorum, quotcunque examinavi, planorum, politorum, scabrorum, angulatorum, eandem naturam eademque principia reperi," are the words of his translator*. The experiments of Scheele were quickly confirmed by his friend and patron Bergmann, who pointed out the existence of small quantities of lime in these calculi, without however adding anything of importance to the subject†.

Between this period and the year 1797 the action of various reagents on calculi was examined by several individuals, both in this country and on the continent, principally with reference to the means of dissolving the stone in the bladder. Very little addition however was made to the former knowledge of their chemical composition. Fourcroy, in 1792, published a paper in the *Annales de Chimie*, in which he appears to have mistaken crystals of the phosphate of magnesia and ammonia for those of phosphate of ammonia and phosphate of soda‡.

In 1786 a calculus was examined by Professor Tychsen, which he supposed to consist principally of phosphate of lime§. This appears to have been the first accurate notice of calculi different in composition from those described by Scheele; and two years after, Link, in his *Commentatio de Analysi Urinæ, et de Origine Calculi*, expressly states that two species of calculi exist, one of which contains a large proportion of calcareous earth, while in the other no trace of an earthy salt can be detected‖. Urinary calculi may therefore be assumed to have been divided, about this period, into two species, the uric acid variety, and those composed principally of earthy matter.

It was reserved for the sagacity of Dr. Wollaston to clear up all that was doubtful with regard to the composition of these bodies, by the discovery of five new and distinct species. Dr. Wollaston's paper was published in the Philosophical Transactions for 1797, and, after the discovery of Scheele, forms

* C. G. Scheele, *Opusc. Chem. et Phys.* a G. H. Schæfer. Leipsic, 1789, p. 73.

† *Opusc. Chem.* tom. iv.

‡ *Annales de Chemie*, tom. xvi. p. 63.

§ Crell, *Chemisch Ann.*, b. ii. p. 407.

‖ E. A. Scharling, *De Chem. Calc. Ves. Rationibus.*

the most important addition to the history of urinary calculi. It contains an accurate description of the phosphate of lime calculus, the fusible calculus, the mulberry or oxalate of lime concretion, and the calculi from the prostate gland, together with the composition of the gout concretion.

In the following year, an elaborate paper appeared by MM. Fourcroy and Vauquelin, containing the results of the analysis of more than six hundred calculi. In addition to the varieties previously described by Dr. Wollaston, the urate of ammonia calculus is for the first time noticed in this paper as a distinct species*. This calculus had been hitherto confounded with those of uric acid, and the statement of Fourcroy was considered to be erroneous, until the experiments of Dr. Prout in 1820 confirmed its accuracy†.

MM. Fourcroy and Vauquelin also notice in this paper, the occasional existence of small quantities of silica in oxalate of lime concretions, a fact which has been subsequently remarked by Dr. Yelloly ‡.

In 1810 Dr. Wollaston announced the discovery of the cystic oxide calculus, a peculiar organic principle, in which M. Baudrimont has recently discovered the interesting fact, of its containing a large quantity of sulphur as an essential constituent.

In 1817 another organic principle was described by Dr. Marcet in his Essay on Calculous Disorders, as forming a new species of calculus. To this substance he gave the name of xanthic oxide, from the yellow colour it assumes when treated with nitric acid. The accuracy of Dr. Marcet's experiments has been recently confirmed by MM. Liebig and Wöhler, who have given an elaborate ultimate analysis of this substance, and have proposed for it the name of uric oxide. In the same work Dr. Marcet also describes small masses of albuminous or fibrinous matter as being occasionally found in the bladder. To these he gave the name of fibrinous calculi, supposing them to be derived from the fibrine of the blood. Similar concretions have been observed by Sir B. Brodie § and Dr. Prout. They appear in some instances to be derived from coagulated blood, the colouring matter of which has been washed out; and in others to consist of inspissated albuminous matter secreted probably by a diseased kidney.

* *Ann. de Chemie*, tom. xxxi.

† Annals of Philosophy, vol. xv. p. 436.

‡ Philosophical Transactions, 1830.

§ Lectures on the Diseases of the Urinary Organs.

The only specimens of these concretions in the Museum were taken from the cells of the *Vesiculæ Seminales*. They are of a bright ruby-red colour, perfectly transparent, smooth on their surface and slightly shrivelled. Their fracture is vitreous, and possesses a high lustre. As these bodies differ very materially from urinary calculi, properly so called, they have not been particularly described in the Catalogue.

Brugnatelli, in his *Litologia Umana*, published in 1817, describes several calculi composed of carbonate of lime, a substance which, though previously shown by Proust * to be frequently present in small quantities in mulberry calculi, and by Fourcroy in concretions from the lower animals, had not hitherto been found, in its pure state, in the human bladder.

In the above sketch of the successive steps by which our present knowledge of the composition of urinary calculi has been attained, the names of those authors only have been mentioned, whose discoveries may be said to have formed an epoch in this department of animal chemistry. But there have been many labourers in the same field whose names are omitted, not because their observations are of little value, but because such details are foreign to the objects of this Catalogue.

The various species of urinary calculi from the human subject, with which we are at present acquainted, are as follows :—

1. Uric Acid	discovered by	Scheele . . .	1776.
2. Urate of Ammonia . . .		Fourcroy and Vauquelin	1798.
3. Oxalate of Lime		Wollaston . .	1797.
4. Cystic Oxide		Wollaston . . .	1810.
5. Xanthic Oxide		Marcet . . .	1815.
6. Phosphate of Lime . . .		Wollaston . . .	1797.
7. Phosphate of Magnesia and Ammonia		Wollaston . .	1797.
8. Fusible Calculus		Wollaston . . .	1797.
9. Carbonate of Lime		Brugnatelli . .	1819.

It has been customary to divide calculi into simple, alternating and compound, accordingly as they consist of the same substance throughout, of two or more different layers, or of various ingredients intimately mixed together. Of the latter

* *Ann. de Chemie*, tom. xxxvi.

variety there is no well-marked specimen in this Collection. Urinary calculi are for the most part so very impure, that it would be exceedingly difficult to define what quantity of foreign ingredients should constitute a mixed calculus. The concretions, to which this term might most properly be applied, are some varieties of the fusible species which contain large quantities of urate of ammonia, and the more impure varieties of the concretion of oxalate of lime. As, however, the external character of the calculus is usually determined by the predominating ingredient, this variety has been altogether excluded from the present arrangement.

The following Table shows the manner in which the Human Urinary Calculi have been arranged, together with the number of each variety at present in the Collection.

It is further necessary to observe, that the chemical composition of the nucleus forms the primary division, or Series, and is marked with a capital letter; that each Series is subdivided, accordingly as the calculus may be either homogeneous, or consists of two, three, or more layers. In the subdivision of the alternating calculi, a regular though arbitrary order of the layers, according to the chemical composition of the successive deposits, has been followed; each variety being characterized by a small letter placed after the capital letter, indicating the Series to which it belongs. When an asterisk is placed after the capital letter, the substance is in the pulverulent state, or in the form of gravel.

The calculi are arranged in the cabinets precisely in the same order as they stand in the Catalogue, and are marked with similar letters and numbers.

A Tabular View of the arrangement of the Human Urinary Calculi, exhibiting the number of each Variety at present in the Collection.

SERIES I.—Calculi of which the nucleus or primary deposit consists of Uric Acid.

A.	Uric acid			212
Aa.	Uric acid.	Urate of ammonia		10
Ab.	Uric acid.	Oxalate of lime		8
Ac.	Uric acid.	Earthy phosphates		27
Ad.	Uric acid.	Urate of ammonia.	Uric acid	2
Ae.	Uric acid.	Urate of ammonia.	Oxalate of lime	0
Af.	Uric acid.	Urate of ammonia.	Earthy phosphates	13
Ag.	Uric acid.	Oxalate of lime.	Uric acid	1
Ah.	Uric acid.	Oxalate of lime.	Urate of ammonia	0
Ai.	Uric acid.	Oxalate of lime.	Earthy phosphates	4
Ak.	Uric acid succeeded by four or more layers			1

SERIES II.—Calculi of which the nucleus or primary deposit consists of Urate of Ammonia.

B.	Urate of ammonia			14
Ba.	Urate of ammonia.	Uric acid		21
Bb.	Urate of ammonia.	Oxalate of lime		31
Bc.	Urate of ammonia.	Earthy phosphates		64
Bd.	Urate of ammonia.	Uric acid.	Urate of ammonia	5
Be.	Urate of ammonia.	Uric acid.	Oxalate of lime	4
Bf.	Urate of ammonia.	Uric acid.	Earthy phosphates	6
Bg.	Urate of ammonia.	Oxalate of lime.	Uric acid	11
Bh.	Urate of ammonia.	Oxalate of lime.	Urate of ammonia	0
Bi.	Urate of ammonia.	Oxalate of lime.	Earthy phosphates	32
Bk.	Urate of ammonia succeeded by four or more layers			13

CATALOGUE.

PART I.

Division I.

CALCULI FROM THE URINARY ORGANS OF MAN.

SERIES I.

CALCULI OF WHICH THE NUCLEUS OR PRIMARY DEPOSIT CONSISTS OF URIC ACID.

URIC acid forms the most important constituent of urinary concretions, and whether on account of its more frequent occurrence, or of its priority in discovery, this substance is entitled to the most conspicuous place in every classification of these bodies. Of the whole number of calculi contained in this Catalogue, amounting to about six hundred, nearly one-third consists of uric acid alone; and if to this number be added the calculi of which it forms the nucleus, it will be found that the proportion which this principle bears to every other in constituting the original deposit is nearly as 5 : 12. If we also include those calculi, which are composed of uric acid in combination with ammonia, or some other base, and which may be regarded as consisting essentially

of uric acid, we shall arrive at the important conclusion, that this acid forms the first step towards the formation of eleven-fifteenths of all calculi from the human subject*.

Uric acid is found only as an excrementitious product of animal life, not entering into the composition of any of the animal tissues, nor having been detected in the blood. It is usually associated with the urinary secretion, of which, in many classes of animals, it forms the characteristic ingredient, apparently serving the same office as urea, viz. that of affording a vehicle for removing an excess of nitrogen from the system.

Uric acid is a natural constituent of the urine of Man and of all Carnivorous animals, and in certain forms of disease is secreted in considerable quantities. The semi-fluid urine of Serpents, of Birds, and of many of the Lizard tribe, contains this substance in combination with ammonia; and the decomposed excrement of Sea-fowl which covers many of the small islands in the Southern Ocean, and numerous outlying rocks on our own coast, is also composed in a great measure of the super-urate of ammonia†. Uric acid has been detected in the Malpighian vessels of insects, in the *Cantharis vesicatoria*‡, and in the excrement of the Silk-worm§. In combination with soda‖, it forms the concretions found in the joints of gouty individuals, and recently urate of potass has been discovered among the specimens in this Collection as a urinary concretion from a species of Iguana. In the urine of the Herbivora uric acid is replaced by the hippuric acid, which contains a larger proportion of carbon and less of nitrogen.

Uric acid possesses distinct acid properties; in combination with the bases it forms a class of salts termed urates or lithates. It may be procured in a state of purity by dissolving the excrement of the Boa Constrictor, or uric acid calculi in a boiling solution of potassa; the liquid, when filtered, is to be decomposed by the addition of an acid, when the uric acid precipitates in the gela-

* Dr. Prout, from more extensive data taken from the analysis of several Collections, estimates the proportion at about two-thirds or ten-fifteenths, and there is no doubt but that this, as a general statement, is very correct. In the Norwich Collection, which was carefully examined by the late Dr. Yelloly, the proportion corresponds very closely with that given in the text.—*Phil. Trans.*, 1829, 1830.

† Lond. and Edinb. Phil. Mag., 1841.

‡ Robiquet, *Ann. de Chem.*, 76.

§ Brugnatelli, *Ann. de Chem.*, 96.

‖ Wollaston, *Phil. Trans.*, 1797.

tinous form, which after a few hours, shrinks considerably in volume, and is converted into a mass of shining crystals: thus prepared, it appears as soft shining scales of a white colour and pearly lustre, tasteless, inodorous, scarcely soluble in cold, and rather more so in hot water; its solution feebly reddens litmus paper.

The elementary composition of uric acid*, and also of xanthic or uric oxide and hippuric acid, substances to which it is closely allied by many natural affinities, is as follows:

	Uric acid. Ats.	Uric oxide. Ats.	Hippuric acid. Ats.
Carbon . . .	36·08 = 5 . .	39·86 = 5 . .	60·74 = 18
Nitrogen. . .	33·36 = 2 . .	36·72 = 2 . .	7·85 = 1
Oxygen . . .	28·12 = 3 . .	20·82 = 2 . .	26·45 = 6
Hydrogen . .	2·44 = 2 . .	2·60 = 2 . .	4·96 = 9
	100·00†	100·00‡	100·00§

This acid was first discovered as a constituent of urinary calculi, and its nature pointed out by C. W. Scheele in the year 1776‖, who simply styled it a concrete acid, hitherto unknown.

Uric acid is precipitated from the urine, either in the form of crystalline particles, or of solid masses. The former have a close resemblance to a coarse ferruginous sand, and, when examined by the microscope, are seen to consist of rhomboidal prisms variously modified, which vary in colour from a bright topaz hue to deep red or brownish-red; these crystals are composed of uric acid combined with the colouring matter of the urine, and form the red crystalline gravel of pathologists.

Uric acid is also a principal constituent of various coloured deposits from the urine which do not possess a crystalline character, but form amorphous impalpable powders. The uric acid in these sediments is never in a state of purity,

* Liebig regards uric acid as a compound of two atoms of an hypothetical substance termed uril or urilic acid with one atom of urea, and doubles the number of atoms in each of its constituents.—Turner's Chemistry, by Liebig, part iii. p. 805.

† *Ann. de Chem. et Phys.*, tom. lvi. p. 58.

‡ Poggendorff's *Ann.*, b. xli. p. 397.

§ Ibid., b. xxxii. p. 574.

‖ *Schwed. Abhandl.* B. 37, and Scheele's Chemical Essays by T. Beddoes, 1786.

but is always mixed with urate of ammonia and some peculiar colouring matters, the exact nature of which has not been accurately determined *.

These deposits have been described by Dr. Prout under the name of red, yellow, or pink amorphous sediments, according to the prevailing tint they assume.

Uric acid concretions, as far as their structure is concerned, are divisible into two varieties, which differ not only in their general appearance and structure, but probably also in their mode of formation. The structure of one is laminated, and its texture is compact and semi-crystalline; its surface is commonly smooth, though sometimes granular and finely tuberculated†, the tubercles being smooth and polished (vide Plate I. figs. 1 and 3). In the other variety the lamellar structure is imperfect or totally wanting; its surface is usually rough, and it has a porous and earthy texture (vide Plate I. figs. 2, 9, 13). There are, however, few calculi which present these characters in a perfectly distinct and separate manner, the two forms being either mixed together, or passing by insensible gradations into each other, thus producing very considerable differences in the degree of compactness, hardness, and structural appearance of the more ordinary forms of the uric acid deposit: most commonly the porous or granular variety forms the nucleus of the calculus, its exterior being dense and laminated (vide Plate II. fig. 1).

The laminated variety, when broken, frequently presents a fibrous appearance, as if made up of crystalline fibres radiating from the centre; it readily separates into angular portions in the direction of the radii, and of the concentric layers, and this tendency to fracture is sometimes so great as to take place spontaneously while yet in the bladder, when the fragments either escape by the

* For the various opinions which have been entertained with regard to the nature of the colouring matter in these deposits, see Proust, Scher. Journ. 7. 11; M. Henry, *Ann. de Chim.*, xl. 433; Prout, Annals of Philosophy, Feb. 1820; Stomach and Urinary Diseases, p. lxxx; Berzelius, *Lehrbuch der Chemie*; Brett and Bird, Lond. Med. Gaz., July, August, 1834, and Feb. 1836, p. 799; Turner's Chemistry, by Liebig; M. Fritzche, Lond. and Edinb. Phil. Mag., xv.

† A tubercular exterior is said to indicate the presence of oxalate of lime; such, however, is not invariably the case. There are many uric acid calculi which exhibit the tubercular exterior in the most marked manner, but nevertheless contain hardly a particle of oxalate of lime; while, on the other hand, there are others whose surface is perfectly smooth, though containing a considerable quantity of that substance.

urethra, or become the nuclei of other calculi (vide Plate I. figs. 6, 7, 8, Plate XII. and A 91 and 93). In those calculi which have a denser and more compact structure, the fracture is vitreous and possesses a high lustre. This species of calculus is usually more or less ovoid in figure ; it frequently attains a very large size, and, with the exception of the colouring matter, consists of pure uric acid.

An important modification of this kind of calculus has been described by Dr. Prout under the name of the *pisiform* concretion ; this variety is characterized by its small size, which seldom exceeds that of a large pea, by the great numbers in which it is produced, and by its occurrence at an advanced period of life. The structure of such calculi is invariably crystallized, especially at the centre, and laminated towards the surface (vide Plate II. fig. 12) ; they often acquire flattened surfaces or faces by attrition against each other, and are sometimes coated by a thin layer of urate of ammonia, containing a variable proportion of oxalate of lime, in which case they resemble externally hemp-seed calculi (vide Plate V. figs. 3 and 4).

Of the other variety, the most marked characteristic is its want of a regularly laminated structure. Some specimens appear as an aggregation of large irregular crystalline grains firmly adhering together, and disposed in the form of radiating fibres, between which there are frequently considerable interspaces (vide Plate II. fig. 1), while others present a porous and earthy texture, as if made up of small loosely cohering particles, which are sometimes crystalline, but more frequently amorphous and earthy: the latter generally contain an admixture of urate of ammonia and of the earthy salts, although calculi having this character are occasionally very pure. The form of this variety is generally less regular than that of the laminated calculus, and it is most frequently met with in the kidneys ; when broken, its fracture is granular and unsymmetrical. Concretions similar to these in structure are occasionally, though rarely, found of a white colour, in which case they chiefly consist of urate of soda.

Uric acid concretions vary considerably in colour, but are usually of a yellowish-brown or brownish-red tint. With regard to the exact nature of the colouring matter but little is known.

Calculi which have been exposed for a considerable time to the action of the urine, without undergoing any further increase in size, become slightly rough and porous on their surface ; their colouring matter is also more or less removed,

and they acquire a *bleached* and *water-worn** appearance. Whether calculi contained in the urinary passages are capable of being dissolved by the action of the urine, either alone, or aided by alkaline medicines, is a question of considerable importance, and one on which much difference of opinion exists. There are, however, several calculi in this Collection, the surface of which exhibits every indication of having been eroded by the action of some solvent; nor would it be easy to explain the appearances they present, on any other supposition than that such changes occurred, while the calculi were still in the bladder. (Vide A 167, 168, 169, 170, C f 8, and Plates IV. XII.)

These calculi are externally rough, and very uneven, being marked with numerous irregular depressions and grooves, which are hollowed at the sides, giving to their exterior a porous and worm-eaten appearance†. When divided, the concentric laminæ, of which the calculi are composed, are seen to terminate abruptly at the depressions, as if a portion of the calculus had been broken away. (Vide Plate IV. figs. 1, 2, 7, 8, and Plate XII. figs. 16, 17.)

That these effects were produced while the calculi were still in the bladder, is clearly shown in the specimen C f 8, where all the irregularities of the calculus have been subsequently coated by a deposit of the earthy phosphates, considerable destruction of its outer layers having previously taken place. In general, the exterior of these calculi is covered by a thin crust of impure uric acid, which is extremely friable and of a lighter colour than the other parts. In specimens A 168 and 169, this crust is of a white colour, and consists of urate of soda, affording a strong presumption that soda had been the solvent in these cases. (Vide Plate IV.)

The calculus removed from the bladder of Mr. Hay after death (whose case as related by himself will be found in this work) most probably owes the peculiarly friable texture of its outer layers to the large quantities of soap he was in the habit of taking.

* Prout on Stomach and Urinary Diseases.

† The same fact has been observed by E. A. Scharling in a Thesis entitled *De Chemicis Calculorum Vesicariorum Rationibus*:—"Superficies diversorum calculorum accurate intuentes sæpe videmus graviter ita affectas, ut luculenter appareat, partes quasdam solutas esse," p. 45. And in the Catalogue of the calculi contained in the Royal Surgical Museum of Copenhagen, he remarks, "Superficies exemplum etiam notabilius præbet solutionis chemicæ, quæ jam in ipsa vesica facta est." p. 49.

In some cases, the employment of alkaline medicines during the uric acid diathesis, appears to cause the precipitation of an amorphous earthy-looking deposit, consisting of uric acid mixed with a large proportion of the urates of ammonia and lime, and also of the earthy salts of the urine. Such is probably the origin of the small masses of calculous concretion figured in Plate II. figs. 2, 3, 4, 5.

It has been observed that uric acid calculi sometimes break up spontaneously in the bladder, and there are some few specimens in this collection which from their form and general appearance would seem to have undergone spontaneous fracture. A 29, 91, 93. (Vide Plate I. fig. 6. Plate XII. fig. 10.)

The variety of the uric acid calculus, which, when broken, presents a fibrous or radiated structure, appears to be most liable to undergo this change. This species of calculus is often exceedingly brittle, its laminæ separating readily from each other, and breaking in the direction of its radiating fibres with the greatest facility. Cracks proceeding from the centre to the circumference are often to be observed in these concretions.

With regard to the causes producing this effect, no very satisfactory explanation can be assigned. It is not improbable that in some instances the breaking up of the calculus may be referred to an altered condition of the urine, by which the thin laminæ of urate of ammonia, or the phosphates which are frequently interposed between the layers of an uric acid calculus are decomposed or dissolved, and the calculus consequently falls to pieces. Fragments of such calculi, when macerated for a few days in dilute acetic acid, readily admit of being separated into distinct layers ; it may therefore be easily conceived that a similar effect might be produced upon them, when in the bladder, by an increased acid, or even alkaline condition of the urine.

Slight alterations in the characters of the urinary deposit, producing a difference in the compactness and purity of the different layers of the calculus, would also be probably sufficient to cause its disintegration, independently of any chemical change. Such appears to have been the case in the calculus figured in Plate XII. fig. 10. It has likewise been suggested, that the contractile power of a thickened bladder might be adequate to produce this effect, when aided by a structural arrangement of the calculus peculiarly liable to fracture.

The uric acid calculus when heated becomes black, emits a peculiar odour,

and gradually consumes, giving off a large quantity of hydrocyanate and carbonate of ammonia; there is generally left a minute white alkaline ash, which is pure lime, and results from the decomposition of a small quantity of urate or oxalate of lime. It dissolves readily in a boiling solution of caustic potass, and if to the solution a few drops of muriatic acid be added, the uric acid is precipitated, presenting at first a gelatinous appearance, but quickly becoming a crystalline powder: the presence of urate of ammonia is indicated by the evolution of ammonia during solution in caustic potass; it may also be detected by digesting the calculus, previously reduced to powder, in boiling water for a few minutes, and filtering while hot; the urate of ammonia dissolves, and on cooling is precipitated, either as an amorphous powder, or as little stellated crystals, which, with the aid of a lens, are readily distinguished from crystals of uric acid.

If a small fragment be heated in a watch-glass with a few drops of nitric acid, violent effervescence takes place, and it is dissolved; if the solution be now cautiously evaporated to dryness, the residue acquires a beautiful pink colour, from the formation of a substance termed purpurate of ammonia by Prout and murexid by Liebig: this test is exceedingly delicate, and very characteristic of the presence of uric acid, but cannot alone be relied on, most other calculi containing sufficient uric acid to produce a similar appearance.

Digested in boiling water, the uric acid calculus sparingly dissolves; the solution, on cooling, deposits rhombic prisms of uric acid.

Uric acid calculi are usually remarkably pure, containing little else than the colouring matter of the urine; minute quantities of the following substances are, however, often present, which are enumerated nearly in the order of their frequency: animal matter, urate of lime, urate of ammonia, oxalate and phosphate of lime, urate of soda, with traces of the various saline constituents of the urine. The quantity of animal matter is usually very small: its exact nature it is impossible to determine.

A. *Uric Acid.*

No.

A*. Red crystalline gravel, composed of crystals of uric acid tinged by the colouring matter of the urine.

Presented from the Museum of the London Hospital, 1841.

A 1. Eight small oval calculi and a portion of a ninth ; supposed to have been taken from the same bladder. They were formerly in the possession of William Cheselden, Esq., and consist of nearly pure and very compact uric acid. *Presented by Benjamin Cooper, Esq.,* 1829.

A 2. Two uric acid calculi connected by silver hoops and chain, on the former of which is engraved, "These two stones were extracted from Mr. John Tunniclift, he being 57 years of age, by S. P. of Carswell, June 1706." One of these calculi has been divided, and possesses an excentric nucleus. *British Museum.*

A 3. Three out of four small oval laminated uric acid calculi, which were "extracted from a man between seventy and eighty years of age by Mr. Gunning : he had not had the complaint above three years."—Memorandum by Mr. Hunter. *Hunterian.*

A 4. A small uric acid calculus of a reddish-yellow colour.

Presented by John Gunning, Esq., 1816.

A 5. A small oblong irregularly-shaped calculus voided with the urine by Sir Joseph Banks, Bart., a week after having been overturned in his carriage. It had most probably been lodged in one of the ureters, and it consists of uric acid. (Vide Plate II. fig. 9.)

Presented by Sir E. Home, Bart., 1814.

A 6. A section of a small elongated calculus, consisting of very compact uric acid. *Hunterian.*

A 7. A section of a small elongated uric acid calculus, which was passed by the urethra. *Presented by Sir E. Home, Bart.,* 1814.

A 8. An oblong uric acid calculus. *Presented by Sir Wm. Blizard*, 1819.

A 9. A remarkably flat uric acid calculus, having an excentric nucleus, and the outer surface of which is of a dark orange-red colour.
Presented by Mr. Long's Executors, 1818.

A 10. Seven small calculi, with the following memorandum: "From Doctor Johnstone's patient at Brentford, Nov. 12th, 1768."
Light coloured uric acid with traces of oxalate and phosphate of lime.
Hunterian.

A 11. A compact uric acid calculus, tuberculated on the surface.
Presented by Sir Wm. Blizard, 1819.

A 12. An oval calculus, consisting of compact uric acid.
British Museum, 1809.

A 13. A uric acid calculus of a crescentic figure, and having an excentric nucleus. *Hunterian.*

A 14. An oval calculus, consisting of nearly pure uric acid.
British Museum, 1809.

A 15. Several small calculi, said to be from the prostate gland; they consist of uric acid mixed with a little oxalate and phosphate of lime, and are doubtless of renal origin. *Presented by Sir Wm. Blizard*, 1811.

A 16. A section of an irregularly-shaped uric acid calculus, probably taken from the kidney. *Hunterian.*

A 17. Two small uric acid calculi from the same bladder.
Presented by John Gunning, Esq., 1816.

A 18. A small uric acid calculus, from a man aged 44.
Presented by Everard Home, Esq., 1807.

A 19. Six small flattened oval calculi, composed of uric acid. *Hunterian.*

A 20. An oblong uric acid calculus. *Hunterian.*

A 21. A minute uric acid calculus. *Presented by Everard Home, Esq.*, 1807.

A 22. Two small uric acid calculi, taken after death from the bladder of Jonas Hanway. *Presented by Sir Wm. Blizard*, 1819.

A 23. A laminated uric acid calculus, nearly pure, and very compact.
Presented by William Lynn, Esq., 1827.

A 24. A small oval uric acid calculus "from the urethra of J. Perry." *Hunterian.*

A 25.
A 26.
A 27.
A 28. *British Museum*, 1809.

These four calculi are precisely similar in appearance. They consist of concentric laminæ of nearly pure uric acid, and the appearance of lines radiating from the centre is strongly marked; their exterior is white and porous, probably from having been subject to the action of the urine for a considerable time, and contains a little urate of lime and urate of ammonia, but no urate of soda.

A 29. Fourteen angular portions of calculi, which passed by the urethra: these specimens illustrate the radiated structure of some varieties of uric acid calculi, and the manner in which they occasionally break up from their centres. (Vide Plate I. figs. 6, 7, 8.)
Uric acid mixed at the exterior with urate of ammonia. *Hunterian.*

A 30. A longitudinal section of an uric acid calculus. *Hunterian.*

A 31. A section of an uric acid calculus. *British Museum*, 1809.

A 32. A longitudinal section of an uric acid calculus. *Hunterian.*

A 33. An uric acid calculus. *Hunterian.*

A 34. A transverse section of an uric acid calculus. *Hunterian.*

A 35. Some small irregularly-shaped and very compact uric acid calculi, from the kidney. *Presented by Sir Wm. Blizard*, 1811.

A 36. A flattened oval uric acid calculus. *Presented by Sir Wm. Blizard*, 1819.

A 37. Two sections of small angularly-shaped calculi, together with several very small entire calculi, all of them consisting of uric acid. *Hunterian.*

A 38. A small uric acid calculus the exterior of which is quite free from colouring matter, and contains but a mere trace of earthy matter.
Presented by John Gunning, Esq., 1816.

A 39. A section of an uric acid calculus; the portion surrounding the nucleus is crystallized in the form of diverging grains. *Hunterian.*

A 40. A longitudinal section of an uric acid calculus. *Hunterian.*

A 41. A section of a flat uric acid calculus which was extracted from a man at St. George's Hospital, 1813. *Presented by Sir E. Home, Bart.*, 1813.

A 42. A longitudinal section of an uric acid calculus: the exterior is tuberculated in parts, presenting the appearance of being coated with oxalate of lime, but it contains a mere trace of that substance. *Hunterian.*

A 43. An uric acid calculus, having an excentric nucleus. *British Museum*, 1809.

A 44. Fourteen small uric acid calculi precisely similar in appearance, and have been doubtless taken from the same bladder; some of them have a single, others two processes; their exterior is nearly white and water-worn. (Vide Plate I. figs. 4, 5.) *Hunterian.*

A 45. Several small *pisiform* calculi, with fragments of others, being half the number that were extracted from a person aged 60 years; they consist of uric acid with urate of ammonia and a trace of urate of soda: their surface is nearly white. *Presented by Sir E. Home, Bart.*, 1816.

A 46. A section of an uric acid calculus. *Hunterian.*

A 47. A section of an uric acid calculus, the exterior of which contains traces of urate of ammonia and of oxalate of lime. *Presented by John Gunning, Esq.*, 1816.

A 48. An uric acid calculus, from the kidney. *Hunterian.*

A 49. Two compact uric acid calculi, from the same bladder. *Presented by Dr. Power*, 1821.

A 50. Three calculi from the same bladder, consisting of nearly pure and very compact uric acid. *British Museum*, 1809.

A 51. A large smooth nearly pure uric acid calculus, on which is the following inscription: "Pierre trouvée dans la vessie d'un malade à l'Hotel Dieu (à Paris). Donné par M. de la Veriere, année 1761." *Hunterian.*

A 52. A large flattened uric acid calculus, the exterior of which is tuberculated; the central portion consists of an aggregation of large crystalline grains, while the rest of the calculus is dense and laminated. *Hunterian.*

A 53. Uric acid nearly pure. *British Museum.*

A 54. An uric acid calculus, upon which the phosphates have begun to be deposited. *Hunterian.*

A 55. A large calculus consisting of nearly pure uric acid; the exterior tuberculated surface contains a little oxalate of lime. *Hunterian.*

A 56. A calculus removed by operation from the bladder by Mr. Lynn; it measures two inches and a half in length, and nearly two inches in its greatest diameter.

The nucleus consists of nearly pure compact uric acid; the remainder, which is much looser in texture, contains a little oxalate of lime and urate of ammonia. *Presented by Wm. Lynn, Esq.*, 1827.

A 57. "A long, solid, heavy, smooth human calculus or stone, having a sinus between the large and small end. From Dr. Groenvelt by Mr. Mason." —*Sloanian MS. Catalogue.*

The central portion consists of nearly pure uric acid; the outer contains urate of ammonia. *British Museum*, 1809.

A 58. Compact uric acid mixed with urate of ammonia and a trace of oxalate of lime. *British Museum*, 1809.

A 59. Two calculi, supposed to be from the same bladder, consisting of uric acid mixed with a little urate of ammonia.
Presented by Sir Wm. Blizard, 1811.

A 60. Four small uric acid calculi and the fragments of a fifth; from the same bladder. *British Museum*, 1809.

A 61. Three flat uric acid calculi, whose exteriors are very singularly coloured: they appear to have been taken from the same bladder. *Hunterian.*

A 62. Three calculi "from a Man who had two years been taking alkaline medicines."

Uric acid coated by a thin layer of urate and phosphate of lime.
Presented by Everard Home, Esq., 1807.

A 63. A nearly circular flat calculus, consisting of non-laminated crystalline uric acid; the nucleus contains some urate of ammonia.
Presented by Thomas Keate, Esq.

A 64. A very flat oval calculus composed of uric acid mixed with a little oxalate and phosphate of lime: its exterior is finely tuberculated, and the major part consists of crystalline grains of uric acid disposed in a radiating form. (Vide Plate II. fig. 1.) *Hunterian.*

A 65. A nearly pure uric acid calculus, considerably flattened.
Presented by Wm. Lynn, Esq., 1827.

A 66. An imperfectly laminated calculus consisting of crystalline uric acid mixed with urate of ammonia, and at its exterior with a small proportion of urate of lime and the phosphates. *Hunterian.*

A 67. A section of a large uric acid calculus. *Hunterian.*

A 68. A calculus removed by operation from the human bladder.
Uric acid mixed with a little oxalate of lime.
Presented by Wm. Lynn, Esq., 1827.

A 69. An uric acid calculus, very compact and of a dark colour.
Presented by Sir W. Blizard, 1819.

A 70. A singularly flat uric acid calculus, taken from a blacksmith at St. George's Hospital, 1802. *Presented by Everard Home, Esq.*, 1807.

A 71. A large compact uric acid calculus.
British Museum, 1809.

A 72. A section of a very large pyriform uric acid calculus. *Hunterian.*

A 73. Uric acid nearly pure. *Hunterian.*

A 74. A calculus extracted from a man aged 54, at St. George's Hospital, December 1803.
It consists of uric acid partially covered by the fusible calculus.
Presented by Everard Home, Esq., 1807.

A 75. A large calculus, consisting of uric acid with a very thin layer of the mixed phosphates on its exterior: this calculus was accompanied by the following history in the Sloanian Catalogue, although from its size it is scarcely credible, being two inches, and an inch and a half in its two short axes, and two inches and a half in its long axis.

"A stone voided by a woman without being cut; given me by Dr. Massey." *British Museum*, 1809.

A 76. An uric acid calculus. *Presented by Sir Wm. Blizard*, 1819.

A 77. Uric acid. *Hunterian.*

A 78. A calculus extracted by Mr. Home from a man at St. George's Hospital. Uric acid mixed with a little oxalate of lime.
Presented by Everard Home, Esq., 1811.

A 79. Uric acid mixed with a little phosphate of lime. *Hunterian.*

A 80. A transverse section of an uric acid calculus. *Hunterian.*

A 81. A section of an uric acid calculus, extracted from a boy in St. George's Hospital. *Presented by Everard Home, Esq.*, 1807.

A 82. A flat uric acid calculus, having smooth depressed surfaces on each of its sides: this calculus was enclosed in the same box and presented along with the calculi in C a 9, but they do not appear to have come from the same bladder. *Presented by Benjamin Cooper, Esq.*, 1829.

A 83. A section of a tuberculated uric acid calculus, "From Dr. Groenvelt by Mr. Mason."—*Sloanian Catalogue.*
British Museum, 1809.

A 84. Several angular uric acid calculi, with the fragments of others.
Presented by Sir E. Home, Bart., 1837.

A 85. A small pear-shaped uric acid calculus, having a double nucleus and a depression on one surface, from having been in contact with another stone. *British Museum.*

A 86. A minute uric acid calculus.
"From Dr. Lavater."—*Sloanian Catalogue.*
British Museum, 1809.

A 87. A transverse section of an uric acid calculus.
Presented by John Gunning, Esq., 1816.

A 88. An uric acid calculus, nearly pure at its centre; its outer part is mixed with oxalate of lime. *British Museum*, 1809.

A 89. An uric acid calculus, the greater part of which consists of irregular shaped semi-crystalline grains firmly adhering together, but not laminated.
British Museum, 1809.

A 90. A section of an uric acid calculus. *Presented by Everard Home, Esq.*, 1808.

A 91. A portion of a large uric acid calculus. From the figure and appearance of this fragment, it is probable that the calculus to which it belonged, had broken up spontaneously in the bladder. It is accompanied by the following history from the Sloanian MS. Catalogue:—

"A triangular smooth stone as big as a very small chestnut, cut out of the urethra of one Spurrit, near Leeds in Yorkshire. He had voided three large ones, and had five cut out of the urethra, of which this was one. He had six lodged in the urethra when he died of a mortification of it, and he had likewise two large ones in the bladder and two in the right kidney, the left being degenerated into a mucilage. From Mr. Thoresby." *British Museum*, 1809.

A 92. Two renal uric acid calculi. *Hunterian.*

A 93. Four irregularly-shaped calculi which have probably formed part of a large calculus that had spontaneously broken up in the bladder; they consist of uric acid with layers of urate of ammonia, and are surrounded by a narrow layer of that substance. *Presented by Sir Wm. Blizard*, 1819.

A 94. A section of an uric acid calculus. "From Dr. Groenvelt."—*Sloanian MS. Catalogue.* *British Museum*, 1809.

A 95. Uric acid with a trace of oxalate of lime. *British Museum*, 1809.

A 96. A section of a compact uric acid calculus. *Hunterian.*

A 97. A longitudinal section of a compact uric acid calculus. *Hunterian.*

A 98. Uric acid with a little oxalate of lime. *British Museum*, 1809.

A 99. A large uric acid calculus slightly coated by the phosphates; it measures

three inches in its long diameter, and two inches in its transverse diameter. *Hunterian.*

A 100. A longitudinal section of an uric acid calculus, the nucleus and exterior of which is non-lamellated, consisting of crystalline grains disposed in a radiating form.

A 101. A large uric acid calculus of a light colour, slightly coated by the phosphates. *British Museum*, 1809.

A 102. An uric acid calculus flattened at the sides. *Presented by Everard Home, Esq.*, 1811.

A 103. A longitudinal section of an imperfectly laminated uric acid calculus. *Hunterian.*

A 104. A compact laminated uric acid calculus divided transversely. *Hunterian.*

A 105. Calculus extracted from the bladder. Uric acid. *Presented by Everard Home, Esq.*, 1807.

A 106. A section of a large calculus, consisting of uric acid with a little oxalate and phosphate of lime. *Hunterian.*

A 107. Three angular uric acid calculi and fragments of several others, from a person aged 72; their structure is compact and lamellar. (Vide Plate I. figs. 10, 11, 12.) *Presented by Sir E. Home*, 1816.

A 108. A large oval calculus consisting of uric acid with a little oxalate of lime. (Vide Plate I. fig. 1.) *British Museum*, 1809.

A 109. Uric acid mixed with urate of ammonia and a little oxalate of lime: the structure of this calculus is porous, and it does not consist of concentric laminæ. *Presented by Mr. Keate.*

A 110. An undivided uric acid calculus, finely exhibiting the tuberculated exterior; it is inclosed in a box, on the lid of which is engraved, "This stone was extracted by William Cheselden, Esq., from William Nightingall, on April 20th, 1737; its weight six ounces and a half, and in circumference nine inches: the operation was effected in half a minute." (Vide Plate I. fig. 3.) *Presented by Edward Stanley, Esq.*

A 111. A large uric acid calculus which weighs six ounces avoirdupois: this

calculus has been accidentally broken, and the fractured surface exhibits in a very characteristic manner the appearance of fibres radiating from the centre; the central portion of the calculus is entire, and is coated by a thin gray layer of urate of ammonia.

Presented by Sir Wm. Blizard, 1819.

A 112. A large uric acid calculus with the following memorandum in the Sloanian MS. Catalogue:—

"This stone was extracted out of the bladder of a woman in St. Bartholomew's Hospital by Mr. Salter. She lived several years after, but could never hold her water. From Dr. Woodward."

It measures 2¾ inches through its long axis, and 2 inches and 1½ inch through its two short axes. The centre of this calculus is not laminated, but granular, with large interspaces, while the exterior is dense and imperfectly lamellar. *British Museum*, 1809.

A 113. A large uric acid calculus taken after death from the bladder of Mr. Hock, butcher at Greenwich. It has a deep groove on its surface, probably caused by the passage of the urine; this groove is frequently found on large calculi, especially when attended by complete incontinence of urine. It weighs 5½ ounces avoirdupois, and measures through its respective axes, 3, 2⅜, and 1½ inches.

"Nephritic symptoms commenced when 50 years of age, increasing gradually for 14 or 15 years, when he had no power of retaining his urine, but it was constantly coming away. Under these circumstances he had agreed to submit to the operation of lithotomy. As he formed this resolution voluntarily, many delays were framed, till at length he thought himself somewhat relieved, and this was in time confirmed, so that for four or five years prior to his death at the age of 74, he was capable of retaining his urine and making it regularly, although in small quantity. After his death this stone was taken from his bladder, which was much thickened and possessed very little space beyond what the stone occupied."

Presented by Sir Charles Blicke, with the above history, 1804.

A 114. A calculus weighing 3 ounces 14 dwts.; the inner portion, which is,

porous and granular, consists of uric acid mixed with urate of ammonia; while the exterior, which is dense and lamellated, consists of nearly pure uric acid. *Presented by Sir Wm. Blizard,* 1819.

A 115. A large compact laminated uric acid calculus, weighing nearly 10 ounces, and measuring through its respective axes, $3\frac{3}{4}$, $2\frac{3}{4}$, and 2 inches; the inner portion of this calculus is mixed with a little phosphate of lime, the outer with a little oxalate of lime: it was formerly in the possession of William Cheselden, Esq. *Presented by Benj. Cooper, Esq.*

A 116. A section of a large uric acid calculus, the nucleus of which consists of an aggregate of crystalline particles of uric acid, mixed with urate of ammonia. *British Museum,* 1809.

A 117. A large tuberculated uric acid calculus; its exterior is dense and laminated, and is mixed with a little oxalate of lime and the phosphates, while the inner portion is porous and has an earthy texture.

Presented by Thomas Keate, Esq.

A118. A large broken calculus composed of uric acid mixed with variable proportions of urate of ammonia; the exterior consists of nearly pure uric acid. *Presented by John Gunning, Esq.,* 1816.

A 119. An oval uric acid calculus, on one end of which is a remarkable accumulation of a mixture of uric acid and the mixed phosphates; it measures $3\frac{3}{4}$ inches in length, and $1\frac{3}{8}$ inch across. *Hunterian.*

A 120. The fragments of a stone "extracted from a man 69 years of age, at St. George's Hospital. The whole was completely removed, but it took nearly an hour, and the man, who was very corpulent, died soon after being put to bed. The stone, when whole, could not be brought away in several trials, and then broke. It weighed $6\frac{1}{2}$ ounces immediately after the operation."

Uric acid and urate of ammonia, with a trace of oxalate and phosphate of lime. *Presented by Everard Home, Esq.,* 1807.

A 121. An uric acid calculus; the central portion contains a small quantity of the mixed phosphates, and is similar in structure to A 117; the exterior is nearly pure. *Hunterian.*

A 122. An uric acid calculus exhibiting the granular, semi-crystalline and non-laminated structure of some uric acid calculi; its surface is rough and tubercular, and the centre is mixed with a pinkish red colouring matter resembling in appearance the purpurate of ammonia. (Vide Plate I. fig. 2.) *British Museum,* 1809.

A 123. An uric acid calculus, "taken out of Mr. Buxton's kidney, having complained of it for 30 years."

"From Dr. Grew's Collection."—*Sloanian MS. Catalogue.* (Vide Plate II. figs. 10, 11.) *British Museum,* 1809.

A 124. A broken calculus, consisting of uric acid mixed with some urate of ammonia, especially at the exterior of one of the halves, where it also contains a little oxalate of lime and red colouring matter.

Leverian Museum, 1806.

A 125. A large uric acid calculus, extracted by the high operation by Sir E. Home. The outer layers of this calculus have separated from the rest, owing to a thin intervening layer of the earthy phosphates.

Presented by Sir E. Home, Bart., 1827.

A 126. "A calculus from the human bladder, having a slender piece of steel for its nucleus;" it consists of impure uric acid, with irregular layers and partial deposits of urate of ammonia mixed with oxalate and urate of lime. The deposit of uric acid or any other substance except the earthy phosphates upon foreign bodies in the bladder, is exceedingly rare; yet from a careful examination of this calculus, there is no reason to doubt its being genuine. (Vide Plate IV. fig. 6.)

Presented by Sir Wm. Blizard.

A 127. Fragments of an uric acid calculus.

Presented by Sir Wm. Blizard, 1819.

A 128. Impure uric acid calculus, with a plaster cast of the same. *Hunterian.*

A 129. A calculus "from Mrs. Hawke," consisting of uric acid mixed in various proportions with the phosphates, urate of ammonia and oxalate of lime; the outer layers are nearly pure uric acid: its texture is for the most part loose and porous. *Presented by Sir Wm. Blizard,* 1811.

A 130. A calculus "from a man aged 46, at St. George's Hospital, January 1798." Uric acid and urate of ammonia with a little earthy matter, principally oxalate of lime. *Presented by Everard Home, Esq.*, 1807.

A 131. Non-laminated uric acid with a trace of oxalate of lime, thinly coated by the mixed phosphates. *Presented by Dr. Power*, 1821.

A 132. Uric acid, not quite pure at the exterior.
Presented by Dr. Power, 1821.

A 133. A transverse section of an uric acid calculus, the exterior of which is mixed with urate of ammonia, and the nucleus consists of large crystalline grains distinctly diverging. *Presented by Dr. Power*, 1821.

A 134. Uric acid, with some urate of ammonia.
"From Dr. Groenvelt by Mr. Mason."—*Sloanian MS. Catalogue.*
British Museum, 1809.

A 135. An impure uric acid calculus, divided transversely. The exterior is rough, and is covered by a thin porous coat of uric acid mixed with urate of ammonia and urate of lime, probably resulting from the long-continued action of the urine. Presented to Sir H. Sloane by Dr. Cyprianus. *British Museum*, 1809.

A 136. Uric acid mixed with a little oxalate and phosphate of lime.
British Museum, 1809.

A 137. "Four round peas-like stones, smooth and polished; voided from the bladder of a woman in the Workhouse in St. Giles's parish." From Dr. Mortimer.—*Sloanian MS. Catalogue.*
Uric acid with thin intervening layers of urate of ammonia.
British Museum, 1809.

A 138. A renal calculus, consisting of uric acid with a little urate of ammonia.
Hunterian.

A 139. A calculus composed of uric acid and urate of ammonia mixed with the phosphates. *British Museum*, 1809.

A 140. Twelve small rounded calculi and fragments of others, supposed to be from the same bladder.

Uric acid and urate of ammonia, with traces of oxalate of lime. "From Dr. Groenvelt."—*Sloanian MS. Catalogue.*

British Museum, 1809.

A 141. A broken calculus, consisting of uric acid with urate of ammonia.

British Museum, 1809.

A 142. A small impure uric acid calculus, having porous concentric laminæ.

Hunterian.

A 143. "A calculus from the urethra of Mr. Dawson," composed of uric acid with urate of ammonia. *Presented by Everard Home, Esq.,* 1807.

A 144. A very minute uric acid calculus, taken from the urethra of a boy.

Presented by Sir Anthony Carlisle, 1821.

A 145. A small impure uric acid calculus. *Hunterian.*

A 146. Several small uric acid calculi, which were passed by the urethra.

Hunterian.

A 147. Portions of a small impure uric acid calculus.

Presented by Sir Wm. Blizard.

A 148. A small pisiform uric acid calculus.

"From Dr. Groenvelt."—*Sloanian MS. Catalogue.*

British Museum, 1809.

A 149. Fragments of a broken impure uric acid calculus.

Presented by Sir Wm. Blizard, 1819.

A 150. Fragments of an uric acid calculus. *Hunterian.*

A 151. Thirty small calculi from the same bladder, consisting of uric acid mixed with oxalate of lime and a little urate of ammonia. *Hunterian.*

A 152. Several small elongated uric acid calculi, from the kidney. "From Dr. Groenvelt."—*Sloanian MS. Catalogue.*

British Museum, 1809.

A 153. "A stone voided by Mrs. ——, of Round Court."—*Sloanian MS. Catalogue.*

A small oblong uric acid calculus, the outer layers of which contain urate of ammonia. *British Museum,* 1809.

A 154. Three small irregularly shaped uric acid calculi, passed from the bladder of a young lady. *Presented by W. A. Hillmann, Esq.*, 1841.

A 155. Portions of an impure uric acid calculus.

Presented by Sir Wm. Blizard.

A 156. A small uric acid calculus, which was four or five days passing through the urethra. *Presented by Everard Home, Esq.*, 1807.

A 157. A fragment of a calculus composed of uric acid and urate of ammonia.

Hunterian.

A 158. A very flat laminated uric acid calculus, one inch and three quarters long by a quarter of an inch in thickness.

Removed by operation from a man upwards of seventy years of age, at the London Hospital, Oct. 21, 1825.

Presented by Sir Wm. Blizard.

A 159. A portion of a calculus.

Impure uric acid with a little of the phosphates deposited between its layers. *Hunterian.*

A 160. A renal calculus, consisting of uric acid mixed with a little urate of ammonia; its structure is earthy and granular, and the exterior is rough. "From Dr. Woodward."—*Sloanian MS. Catalogue.*

British Museum.

A 161. A small broken uric acid calculus. "From Dr. Groenvelt by Mr. Mason." —*Sloanian MS. Catalogue.* *British Museum.*

A 162. Fragments of a flat uric acid calculus.

Presented by Sir Wm. Blizard, 1819.

A 163. The centre of this calculus consists of impure uric acid, around which is a layer containing a considerable proportion of phosphate and oxalate of lime. The exterior is very compact, and is nearly pure uric acid.

Presented by N. Hills, Esq., 1823.

A 164. A large renal calculus, the structure of which is earthy and porous; it consists of loosely cohering particles of uric acid mixed with urate of

ammonia; traces of a lamellar structure are visible at some parts near the exterior; its surface is rough and earthy looking.

British Museum.

A 165. A large renal calculus which has apparently undergone partial solution; its surface is covered by the irregular earthy looking coat composed of uric acid, urate of ammonia, urate of lime, and the phosphates, which is usually found on calculi that have been acted upon by the urine.

British Museum.

A 166. An uric acid calculus mixed with a little urate and oxalate of lime. The nucleus consists of large diverging crystalline grains, while the exterior is dense and composed of concentric laminæ. *British Museum.*

The exterior of the four following calculi exhibits decided indications of having undergone partial solution, either from the action of the urine alone, or of alkaline medicines; in 168. and 169. the solvent appears to have been soda, both of these calculi being coated by a thin crust of urate of soda. Vide Introduction, p. 5.

A 167. "From Mr. Paul by Mr. Ranby."—*Sloanian MS. Catalogue.*

Imperfectly lamellar uric acid mixed with a considerable proportion of oxalate of lime. *British Museum.*

A 168. A nearly spherical calculus with a small process projecting from it, apparently formed by solution of the adjacent parts. Its surface presents a worm-eaten appearance, and is covered with a thin white crust, consisting of urate of soda with urate of ammonia and a trace of phosphate of lime. The centre of the calculus consists of crystalline uric acid. (Vide Plate IV. figs. 1, 2.)

A 169. An uric acid calculus, the exterior of which is nearly similar to the preceding, but exhibits the grooved irregular surface in a more marked manner; the white crust also consists of urate of soda. (Vide Plate IV. figs. 7, 8.) *Hunterian.*

A 170. An uric acid calculus, the nucleus of which is made up of crystalline grains, while the remainder is dense and laminated; it is coated in parts by an earthy looking mixture of uric acid, urate of ammonia, and urate of

lime; the surface of the calculus, from which this coat has been removed, is smooth, and has small elevations and depressions, apparently resulting from the action of some solvent. *Hunterian.*

A 171. Three hundred and seven irregularly-shaped masses of calcareous concretion "from a man aged 77 years, which weighed 9 ounces 7½ drachms, and also seven small ones which passed before alkalies were used; the patient had taken alkaline medicines in large quantities for several years."

Of the small calculi that were passed prior to the use of alkalies there are at present only five specimens; they consist of nearly pure uric acid. The others are composed principally of uric acid and urate of ammonia, mixed with some urate of soda and urate of lime, and traces of phosphate of lime and the triple phosphate. Some of the larger specimens contain a small uric acid calculus as a nucleus, similar to those voided by the urethra, and most of them present more or less distinct appearances of portions of the same.

Although there is no further history of this interesting case than that given above, these specimens probably afford a striking instance of the effect produced by the injudicious use of alkalies, the secretion of uric acid not having been arrested, but merely altered as to the form in which it was deposited. The small calculi, passed before alkalies were used, are of the kind termed *pisiform* by Dr. Prout; some of them appear to have broken up in the bladder, and afterwards to have become encrusted with the amorphous deposit. (Vide Plate II. figs. 2, 3, 4, 5.) *Presented by Everard Home, Esq.*, 1807.

A 172. Five broken calculi, consisting of uric acid and urate of ammonia with a little phosphate and oxalate of lime. They appear to have been taken from the same bladder, and to have been acted on by alkaline medicines. *Hunterian.*

A 173. A calculus extracted from a man 70 years of age, at St. George's Hospital.

The nucleus consists of crystalline particles of nearly pure uric acid; upon this is deposited uric acid mixed with oxalate of lime, phosphate

of lime, and urate of ammonia, which is surrounded by a layer of nearly pure uric acid; a small quantity of the earthy phosphates coats the exterior. (Vide Plate I. fig. 13.) *Hunterian.*

A 174. Uric acid mixed with urate of ammonia, and having a little phosphate of lime diffused through it; the texture of this calculus is earthy and porous, and it is quite destitute of the lamellar structure. (Vide Plate I. fig. 9.) *Presented by Dr. Power*, 1821.

A 175. A calculus from the bladder of "Mr. Fowler."
Uric acid with a little oxalate of lime. *Hunterian.*

A 176. A small flat calculus "from Mr. Harrison, who had it ten years and took all the solvents."
Uric acid, having a porous and lamellar structure, with traces of urate of ammonia, urate of soda, and oxalate of lime; it is partially coated by phosphate of lime. *Hunterian.*

A 177. Several small *pisiform* uric acid calculi; many of them have separated into triangular portions, in a similar manner to those represented in Plate I. figs. 6, 7, 8. *Hunterian.*

A 178. Three small uric acid calculi "discharged from the urethra of a Man, aged 69; the largest weighs only 5 grains."
Presented by James Briggs, Esq., 1832.

A 179. A laminated oval uric acid calculus. *Hunterian.*

A 180. A laminated oval uric acid calculus, remarkably dense and compact; the surface is slightly tubercular.
Presented by J. G. Andrews, Esq., 1841.

A 181. "Two small urethral calculi, one of which was removed by excision;" the largest consists of uric acid mixed with, and partially coated by oxalate of lime; the other is composed of urate of soda.
Purchased from the Collection of Dr. Jenner.

A 182. A small renal uric acid calculus, the surface of which is of a bright orange colour. *Presented by Sir E. Home*, 1833.

A 183. A small renal calculus consisting of impure uric acid.

A 184. A small flat oval calculus taken after death from the bladder of William Hay, Esq., who took three ounces of Mrs. Stephens's medicines every day during five years, and for a considerable time afterwards a quantity of Castile soap, and also lime-water. According to Dr. Russel, this calculus when first taken out of the bladder "weighed 3 drachms 2 scruples 8 grains, was flat and oval, of a shining chestnut colour, perfectly polished, and smooth to the touch in every part. Being desirous to see what the outward laminæ were composed of, I found the outer one thin and friable, the other thicker and of a brown loam colour."—*Whytt's Works*, 1768, 4to, p. 460. At present the greater portion of the outer layers are wanting; what remains consists of loosely cohering friable layers of urate of ammonia mixed with urate of lime, while the rest of the calculus is composed of compact impure uric acid. This difference in composition and appearance has been in all probability produced by the use of alkaline medicines; but it may remain a question whether the change was effected upon the surface of the calculus already formed, or whether the uric acid was deposited upon the original calculus in an altered state, while the patient was under the influence of alkalies. Experience has fully confirmed the accuracy of Dr. Whytt's concluding remark, "that Mrs. Stephens's medicines, or soap and lime-water, may give great relief to patients, and make them pass through life easily, even although they have little effect in dissolving the stone." Mr. Hay continued taking his remedy to the last day of his life; he died of apoplexy in July 1775. By his own desire his body was opened, and the calculus contained in the bladder was placed in Sir Hans Sloane's Collection, from which it was transferred to the College by Sir Joseph Banks. Mr. Hay published a pamphlet, called an 'Essay on Deformity,' at the end of which is a minute history of his own case, and his opinion as to the efficacy of Mrs. Stephens's medicines, from which account the following has been taken: "For many years red sand constantly came from me without pain or inconvenience. About nine years ago I began to be uneasy, and before twelve months had passed was so much out of order that I could no longer ride; the motion of a coach grew insupportable, and that of a chair or walking

was generally attended with bloody water. I took Mrs. Stephens's medicines in the solid form, three ounces a day, for about five years, when I changed it for the same quantity of Castile soap, which about a year since I reduced to two ounces, and lately to one ounce with about a pint of lime-water mixed with milk, being willing to regain my liberty as far as is consistent with ease and safety. This regimen I have incessantly pursued, except some few days that I have purposely omitted it to observe the consequence of such omission. Whilst I pursue this regimen, I never discharge red sand, whenever I omit it for a few days I constantly do; by a steady perseverance in it my particular complaint has been gradually diminished and my health in general improved. I believe I could now ride, though I have not tried. I seldom feel any uneasiness in a coach, and when I do it is inconsiderable, though sometimes, though very rarely, it is attended with bloody water, and the motion of a chair or walking does not affect me. In short, I have exchanged pain for ease, and misery for comfort; and had it not been for this medicine, I should not have been alive to tell my story." (Vide Plate IV. fig. 3.)

The calculus is mounted between glasses in a gold frame, on which is engraved "this stone weighs 99 grains," and this is enclosed in a gold box. It was also accompanied by a manuscript on vellum in a gold mounted shagreen case. *British Museum.*

A 185. A small impure uric acid calculus.

A 186. A section of a calculus, consisting of uric acid and urate of ammonia, with about forty per cent. of the mixed phosphates: this calculus may be termed a mixed calculus; in appearance it resembles the mixed phosphates. *British Museum.*

A 187. Eleven small uric acid calculi. *Presented by W. T. Brande, Esq.*, 1842.

A 188. Several small pale-coloured calculi, consisting of nearly pure uric acid. *Presented by W. T. Brande, Esq.*, 1842.

A 189. Numerous small tuberculated calculi of a dark colour, consisting of crystalline uric acid.

These calculi were passed at different times during a period of three years, by Mr. Lee, aged 71, who in other respects enjoyed good health. *Presented by W. T. Brande, Esq.*, 1842.

A 190. A small uric acid calculus mixed with urate of ammonia.
Presented by W. T. Brande, Esq., 1842.

A 191. Two small compact uric acid calculi, removed by operation by Sir E. Home. *Presented by W. T. Brande, Esq.*, 1842.

A 192. A section of a compact laminated uric acid calculus, measuring four inches in length by three inches across.
Presented by W. T. Brande, Esq., 1842.

A 193. An uric acid calculus, the surface of which is highly tubercular, but the tubercles do not contain any oxalate of lime. The white portion immediately surrounding the nucleus is mixed with urate of lime and some urate of ammonia, while the rest of the calculus consists of tolerably pure uric acid of the ordinary colour. This difference has been produced by the patient having taken soda; the presence of soda cannot, however, be detected. *Presented by W. T. Brande, Esq.*

A 194. A section of a large *pisiform* uric acid calculus, showing the crystalline nucleus and laminated exterior belonging to that variety. (Vide Plate II. fig. 12.)
This calculus was the second voided by the urethra of a nobleman above seventy years of age. *Presented by Thomas Taylor, Esq.*, 1842.

A 195. The two sections of a very compact uric acid calculus.
Presented by the Family of the late John Abernethy, Esq., 1842.

A 196. Twelve *pisiform* concretions, being part of fifty-eight that were found in the bladder of a person after death. *Presented by G. J. Guthrie, Esq.*

A 197. A section of an uric acid calculus, containing a large proportion of the earthy phosphates. It is very similar in appearance to A 186.
Presented by W. T. Brande, Esq., 1842.

A 198. A renal calculus, taken from Gilbert Holker, M.D. The small irregular concretions accompanying this calculus were passed by the urethra.
Presented by Thomas Taylor, Esq., 1842.

A 199. A section of a compact uric acid calculus containing thin alternating layers of earthy matter; the exterior contains oxalate of lime.

Presented by Thomas Taylor, Esq., 1842.

A 200. A section of a small compact uric acid calculus.

Presented by Thomas Taylor, Esq., 1842.

A 201. A section of a small compact uric acid calculus. *Hunterian.*

A 202. Four small calculi consisting of compact laminated uric acid; their surface is of a bright brick-red colour, and they have not the slightest appearance of having been in contact with each other. Case related by Mr. Swan in the 'Edinburgh Medical and Surgical Journal,' July 1824, p. 92, from which the following is extracted:—

Mr. C., æt. 74, had enjoyed very good health until the beginning of September 1820, when he became feverish and had a disordered state of the digestive organs. A short time after this he began to suffer irritation in his bladder, and frequently passed red sand and calculi of different sorts. The urine was for the most part clear. Subsequently a large tumour appeared in the situation of the left kidney, and an abscess formed by the side of the anus. He died on the 3rd of October, 1821.

On examination it was found that the left kidney was very large, and had a large cavity within it containing putrid matter. In the infundibula there was some red sand, exactly like that usually observed in the urine. After the matter was removed, the kidney weighed 2½ pounds avoirdupois. The right kidney was sound, and weighed 7 ounces. The bladder contained four calculi, and was sound, except a slight enlargement of the prostate gland. There was a stricture in the rectum. *Presented by Joseph Swan, Esq.*, 1842.

A 203. Three small flattened oval calculi, consisting of compact laminated uric acid. Their external surfaces are slightly flattened and smooth at some points, from contact with each other.

From William Russell, whose case is related by Mr. Swan in the 'Edinburgh Medical and Surgical Journal,' July 1824.

Presented by Joseph Swan, Esq., 1842.

A 204. Twenty-nine small calculi, being part of thirty-six that were removed from the bladder of J. Cunningham, æt. 66; the patient recovered. Operation performed by Mr. Liston.

These calculi vary in size from a quarter to rather more than half an inch in diameter, and are of a flattened nearly circular figure. They consist of nearly pure uric acid; the outer layers are much lighter in colour than the inner, and their external surface is rough and nearly white, as if water-worn. *Mus. Liston*, 1842.

A 205. Several large fragments of two uric acid calculi, which were extracted from the bladder of David Law, æt. 60, by Mr. Liston. The calculi broke down during the operation. The patient recovered.

Mus. Liston, 1842.

A 206. A large oval calculus and a small crescentic-shaped calculus, removed from the bladder of James Craigie, æt. 70. The patient recovered. Operation performed by Mr. Liston.

They consist of compact laminated uric acid; the smaller calculus is smooth and polished on its concave surface, and appears to have been in contact with one of the extremities of the larger calculus.

Mus. Liston, 1842.

A 207. An uric acid calculus, extracted by Mr. Green from the bladder of James Charman, aged 60, a patient in Thomas's Hospital. The patient recovered.

This calculus is of a remarkably flattened oval figure; its external surface is on one side nearly smooth, the other is finely tuberculated. It is not divided. *Presented by J. H. Green, Esq*, 1842.

A 208. An uric acid calculus. *Presented by Dr. U. Cumin*, 1842.

A 209. An uric acid calculus, broken transversely.

Presented by Dr. U. Cumin, 1842.

A 210. Nine small uric acid calculi, taken after death from the bladder of an old man, in whom there had been symptoms of stone during life.

The external surface of these calculi consists of a thin layer of urate of lime. *Presented by Dr. U. Cumin*, 1842.

A 211. An oblong uric acid calculus divided transversely; its exterior is granular. *Presented by Dr. U. Cumin,* 1842.

A 212. A large uric acid calculus, the external surface of which presents numerous irregular excavations and grooves. The peculiar appearance of the exterior of this calculus has evidently resulted from the action of some solvent, and was most probably produced while the calculus was in the bladder. *Presented by Dr. U. Cumin,* 1842.

A a. *Uric Acid. Urate of Ammonia.*

The layer of urate of ammonia in all these calculi is extremely thin; in no case does it exceed one-eighth of an inch in thickness: although generally well defined, it appears in many instances to be but a preliminary step towards the deposition of the earthy phosphates.

These calculi, when of a small size, bear so close a resemblance to the smooth variety of the oxalate of lime calculus, as to be readily mistaken for that species until they are divided. The layer of urate of ammonia is seldom pure, being usually mixed with variable quantities of the urate and oxalate of lime, and sometimes with the phosphates; the two former are occasionally present in large quantities.

A a 1. A nearly round calculus, accompanied by several small flattened calculi which are identical in composition; they consist of nearly pure uric acid coated by a thin layer of urate of ammonia with a little urate of lime. (Vide Plate V. figs. 2, 3, and 4.) *Presented by Sir Wm. Blizard,* 1822.

A a 2. Thirty-five calculi, apparently taken from the same bladder; but their history is unknown; many of them possess smooth surfaces, produced by rubbing one against another. They consist of uric acid surrounded by a grey-coloured layer of urate of ammonia, one-tenth of an inch in thickness; upon this the mixed phosphates have just begun to be deposited. *Hunterian.*

A a 3. A large oval calculus weighing ten ounces, and measuring 4 inches, 2½ and 2 inches through each of its respective axes, with the following memorandum from the Sloanian MS. Catalogue: "A very large stone of the bladder, from Mr. Ranby." Mr. Ranby was Serjeant-Surgeon to King George II., and appears to have presented many calculi to Sir Hans Sloane.

Compact uric acid thinly coated by urate of ammonia.

British Museum.

A a 4. A small oval calculus consisting of uric acid thinly coated by urate of ammonia. "Taken out of the bladder of Mr. ——, who had vast complaints there, but not suspected to have the stone when living. Given to me by Mr. Gunning."—*Memorandum by Mr. Hunter.*

Hunterian.

A a 5. Half a calculus.

Impure uric acid coated by urate of ammonia, containing a large quantity of oxalate and some urate and phosphate of lime.

Presented by Sir Anthony Carlisle, 1821.

A a 6. A calculus weighing 12 ounces 5½ drachms avoirdupois, and measuring 3½ inches, 3, and rather more than 2 inches through each of its respective axes, taken after death from the bladder of Alexander Archer, Nov. 20th, 1796.

Compact laminated uric acid nearly pure, coated by a thin layer of urate of ammonia mixed with a little oxalate of lime, and upon this is deposited in parts the fusible calculus.

Presented by George Chandler, Esq., 1821.

A a 7. Uric acid partially coated by urate of ammonia.

Presented by Wm. Lynn, Esq., 1827.

A a 8. A section of a calculus, together with a small irregularly-formed calculus; they are probably from the same bladder.

Uric acid containing a little oxalate of lime, thinly coated by urate of ammonia also mixed with oxalate of lime. The smaller calculus has a similar composition, but the uric acid appears to have been a portion

of a larger calculus which had probably broken up spontaneously in the bladder and had afterwards become coated by urate of ammonia.

Presented by John Gunning, Esq., 1816.

A a 9. Eight small stones, having the following memorandum by Mr. Home: "Mr. Hay's stones. The prostate gland enlarged like Dr. Fothergill's."

Uric acid coated by a thin layer of impure urate of ammonia.

Hunterian.

A a 10. A calculus having a small nucleus of uric acid surrounded by a thick layer of impure earthy-looking urate of ammonia mixed with variable quantities of oxalate of lime; the layers immediately around the nucleus contain the largest proportion of earthy matter.

Presented by Wm. Lynn, Esq., 1827.

A b. *Uric Acid. Oxalate of Lime.*

The transition from the uric to the oxalic acid diathesis is much less common than that from the oxalic to uric acid. The layer of oxalate of lime in all these specimens is very thin, and offers a striking contrast to the enormous accumulation of uric acid frequently observed upon a nucleus of oxalate of lime. One reason of this may be, that uric acid calculi are often borne with little inconvenience in the bladder, while those of the mulberry variety cause so much suffering, as to induce the patient to submit to an early operation for their removal.

A b 1. A calculus removed by operation by Mr. Lynn, the surface of which is highly spiculated, and of a very dark colour.

Uric acid surrounded by a thin layer of oxalate of lime; as the uric acid approaches the oxalate of lime it becomes mixed with that substance. (Vide Plate II. fig. 6.)

Presented by Wm. Lynn, Esq., 1827.

A b 2. A calculus removed by operation; the patient died a few hours afterwards: formerly in the possession of Dr. Wright, to whom it was given by Dr. Chawner.

Uric acid containing a little oxalate of lime surrounded by irregularly disposed layers of pure oxalate of lime, and of oxalate of lime mixed with uric acid. *Presented by Dr. Power*, 1821.

A b 3. A section of a calculus taken from a man aged 64, at St. George's Hospital in 1799. It weighed $3\frac{1}{4}$ ounces.

Uric acid mixed with oxalate of lime, thinly coated by oxalate of lime. *Presented by Everard Home, Esq.*, 1807.

A b 4. Some small fragments of a calculus.

Uric acid coated by crystals of oxalate of lime. *Hunterian.*

A b 5. Two small oval calculi, which were removed, after death, from the bladder of Mr. Samuel Jackson.

Presented by Sir Anthony Carlisle, 1825, with the following notice:

"Remarks to accompany the stones taken from the urinary bladder of Samuel Jackson, Esq., aged 71 years, and who died March 6th, 1825.

"I had known him during the twelve years of his having been affected with symptoms of stone in the bladder. He had occasional attacks of painful micturition, which were abated by his taking carbonate of soda; he had been sounded about six years before his death, and the touch of stone was discovered, but no indication of there being two stones, neither did he ever feel the grit or sound of them himself, although very watchful of his own symptoms. His pains during and after making water were not greater in the latter years of his life than they were ten years before. I think the stones were kept from augmentation by the taking of soda. There is little evidence of friction on the surface of either stone. The bladder was capable of holding half a pint, thickened, spongy, and flushed with venous blood on its inside. Mr. Jackson died of hydrothorax."

Uric acid coated with a mixture of oxalate and urate of lime, disposed in the form of radiating crystalline fibres, and having a smooth exterior.

A b 6. A calculus having a very rough external surface.

The nucleus of this calculus is composed of nearly pure uric acid; it is surrounded by a grey portion consisting of uric acid mixed with

urate of ammonia. The outer layer consists principally of oxalate of lime mixed with urate of ammonia and phosphate of lime.

Presented by Sir Wm. Blizard, 1819.

A b 7. Section of a calculus consisting of compact laminated uric acid thinly coated by oxalate of lime ; the surface is tubercular.

Presented by Thomas Taylor, Esq., 1841.

A b 8. A small irregularly-formed calculus, somewhat triangular, granulated on the surface, and of a very dark colour.

Impure uric acid coated by oxalate of lime.

Presented by Sir Wm. Blizard, 1819.

A c. *Uric Acid. The Earthy Phosphates.*

A c 1. A section of a small calculus.

Uric acid mixed with oxalate of lime, and coated by compact phosphate of lime ; a few crystals of oxalate of lime are scattered over the exterior ; the phosphate of lime in this calculus is readily fusible. (Vide Plate II. fig. 8.) *Presented by John Gunning, Esq.,* 1816.

A c 2. Half a calculus, composed of uric acid with urate of ammonia, and coated by the phosphates. *Hunterian.*

A c 3. A large urinary calculus, composed of uric acid coated by the mixed phosphates with a little carbonate of lime. (Vide Plate II. fig. 7.)

British Museum, 1809.

A c 4. A portion of a large uric acid calculus, surrounded by the mixed phosphates containing thin layers of urate of ammonia. *Hunterian.*

A c 5. Uric acid with a trace of oxalate of lime, coated by the fusible calculus.

British Museum, 1809.

A c 6. Uric acid surrounded by the fusible calculus ; the outer layers of uric acid are mixed with urate of lime and urate of ammonia.

Presented by Mr. Long's Executors, 1818.

A c 7. "A very large calculus, weighing above 17 ounces, taken from a man of the name of Holdsworth, by an operation performed by Mr. Cheselden in St. Thomas's Hospital upwards of 50 years ago. The man died the next day." (Vide Plate III. figs. 1, 2.)

This calculus consists of three large uric acid calculi which have been cemented together by the mixed phosphates.

Presented by Wm. Wadd, Esq., 1825.

A c 8. "A white stone, which was discharged by an opening in the scrotum near the perinæum of a labourer in Town Malling in Kent, given me by Mr. Bathurst."—*Sloanian MS. Cat.*

It is composed of concentric layers of the fusible calculus deposited upon a small nucleus of impure uric acid; the phosphates are mixed with some carbonate of lime, and a little urate of ammonia.

British Museum, 1809.

A c 9. The centre of this calculus, although of a dirty white colour, contains very little earthy matter, but consists almost wholly of uric acid and urate of ammonia; the exterior consists of phosphate of magnesia and ammonia, with some phosphate of lime.

Presented by John Gunning, Esq., 1816.

A c 10. Uric acid with oxalate and phosphate of lime, surrounded by the mixed phosphates containing a little carbonate of lime.

Presented by Wm. Lynn, Esq., 1827.

A c 11. Uric acid with a trace of oxalate of lime, thinly coated by the mixed phosphates. *Hunterian.*

A c 12. A calculus taken after death from the bladder of Mr. Banks Hodgkinson: this gentleman shot himself during a fit of temporary derangement produced by the irritation of the stone. It weighs above two ounces, and consists of uric acid thinly coated by the mixed phosphates.

Hunterian.

A c 13. The nucleus of this calculus consists of uric acid, around which has been deposited a mixture of uric acid and urate of ammonia, with a small quantity of the mixed phosphates; the whole is surrounded by the phosphates containing a little urate of ammonia. *Hunterian.*

A c 14. A section of a calculus, consisting of uric acid surrounded by the phosphates. *Hunterian.*

A c 15. The composition of this calculus is exactly similar to the preceding. *Hunterian.*

A c 16. A renal calculus moulded to the form of the pelvis of the kidney, consisting of the mixed phosphates deposited upon a small nucleus of impure uric acid. *Hunterian.*

A c 17. Impure uric acid, coated by a mixture of phosphate, oxalate, and carbonate of lime. *Presented by Mr. Long's Executors*, 1818.

A c 18. A transverse section of a calculus.

The nucleus consists of nearly pure uric acid, which is surrounded by a mixture of uric acid, urate of ammonia and a little urate of lime; the whole is coated by the mixed phosphates containing thin layers of urate of ammonia with urate of lime. *Presented by Dr. Power*, 1821.

A c 19. A section of a calculus consisting of uric acid coated by phosphate of lime, with phosphate of magnesia and ammonia, and carbonate of lime. *Hunterian.*

A c 20. Fragments of a small calculus: the nucleus is almost wholly gone, but apparently consisted of uric acid, the remainder consists of phosphate of lime. *Presented by Sir Wm. Blizard*, 1819.

A c 21. Mixed phosphates upon a nucleus of uric acid: the portion immediately surrounding the nucleus is mixed with urate of lime and urate of ammonia. *Presented by Mr. Long's Executors*, 1818.

A c 22. A small oblong calculus having an eccentric nucleus composed of uric acid and urate of ammonia; the exterior consists of the mixed phosphates. *Presented by Wm. Lynn, Esq.*, 1827.

A c 23. A large nearly spherical calculus, consisting of uric acid surrounded by a layer about three-fourths of an inch in thickness of the phosphate of magnesia and ammonia mixed with phosphate and carbonate of lime. *British Museum.*

A c 24. A calculus measuring $1\frac{1}{2}$ inch, 1 inch and $\frac{11}{8}$ths of an inch through each of its respective axes, extracted by Mr. Copland Hutchison from the

bladder of a female above 80 years of age, by dilating the urethra with Weiss' dilator; the operation occupied about an hour. It is composed of uric acid surrounded by a narrow layer of the mixed phosphates. *Presented by A. Copland Hutchison, Esq.*

A c 25. A small calculus, composed of compact crystalline phosphate of lime upon a nucleus of impure uric acid. *British Museum.*

A c 26. Several angular and flattened calculi, being part of eleven taken from the bladder of a man after death.

In this case lithotomy was proposed, but rejected by the patient, who afterwards submitted to the operation of lithotrity, and several portions of calculous matter came away; severe inflammation of the bladder shortly followed, and the patient died, after lingering for twenty months in à state of constant suffering. Upon examination, the kidneys were found much diseased, with abscesses in both of them; the bladder was greatly thickened, and so much contracted as to be capable of containing little more than the calculi.

It was imagined that only one calculus was originally present, and that the fragments of this calculus when crushed formed the nuclei of the others; but the regular figure of their centres clearly shows that such could not have been the case.

Compact laminated uric acid surrounded by uric acid in a pulverulent state, and coated by phosphate of magnesia and ammonia The portion of uric acid immediately surrounding the nucleus fell out, when the calculi were divided.

Presented by Thomas Wormald, Esq., 1841.

A c 27. Numerous small calculi, which with about two hundred others were removed from between the prepuce and glans penis of a very old man. The patient had congenital phimosis, the orifice of the prepuce scarcely admitting the introduction of a common probe. From the presence of the calculi the prepuce was distended to the size of a large pullet's egg, and retention of urine was finally produced.

On dividing the prepuce, one of the calculi was found completely blocking up the orifice of the urethra. The glans penis was in a state

of ulceration, and a large portion of its substance had been absorbed. The patient had, during many years, occasionally experienced great pain and difficulty in making water, and latterly he had a constant stillicidium. The calculi are composed principally of the fusible compound; most of them have a small nucleus of uric acid; their external surface is varnished over with urate of ammonia.

From the composition of the nucleus, there can be no doubt but that the greater number of these calculi had passed from the urethra into the sac of the prepuce; and their irregular form and close adaptation to each other proves, that in this situation they had increased considerably in size by the deposition of the earthy phosphates.

Presented by J. P. Vincent, Esq., 1842.

A d. *Uric Acid. Urate of Ammonia. Uric Acid.*

A d 1. Three calculi, supposed to be from the same bladder, with the following memorandum:

"Three large stones, one oval and large, and two smaller, levigated by rubbing against one another. From Mr. Paul by Mr. Ranby."—*Sloanian MS. Catalogue.*

Central and outer portion, uric acid nearly pure; grey layer between these, urate of ammonia mixed with oxalate and urate of lime. (Vide Plate V. fig. 6.) *British Museum*, 1809.

A d 2. A section of a large vesical calculus, having a double uric acid nucleus, around which is a thin layer of urate of ammonia with oxalate of lime, the remainder nearly pure uric acid.

"A very large stone, hard and heavy, taken out of the bladder of a man after his death, with some sulci or furrowes in it."—*Sloanian MS. Catalogue.* *British Museum.*

A e. *Uric Acid. Urate of Ammonia. Oxalate of Lime.*

Of this variety of calculus the Museum possesses no specimen.

A f. *Uric Acid. Urate of Ammonia. Earthy Phosphates.*

The transition from the uric acid to the phosphatic diathesis, is very frequently preceded by the deposition of urate of ammonia: this substance forms either a distinct intermediate layer or is mixed with the other deposits. In the following calculi the layer of urate of ammonia, though usually small, is sufficiently pure to be regarded as a distinct layer; the tests that have been relied on in determining this point, are, its decrepitation when heated, and its burning away without leaving any very considerable residue.

The successive changes occurring in the transition from the uric to the confirmed phosphatic diathesis are beautifully shown in Plate V. fig. 9.

A f 1. Uric acid coated by the mixed phosphates, between which is a layer of urate of ammonia. *Hunterian.*

A f 2. Uric acid mixed with a little oxalate of lime, upon which is deposited impure urate of ammonia; the exterior consists of the mixed phosphates. *Presented by W. T. Brande, Esq.*, 1808.

A f 3. This calculus appears to have been one half of an oblong uric acid calculus, which after it had been broken in the bladder, has become coated, first by urate of ammonia and subsequently by the mixed phosphates; it has no history. *Presented by Dr Power*, 1821.

A f 4. A small circular and very flat calculus, consisting of uric acid thinly coated by a layer of urate of ammonia, and also of the mixed phosphates. *Presented by Sir E. Home, Bart.*, 1814.

A f 5. Uric acid surrounded by the mixed phosphates, between which is a grey layer consisting principally of urate of ammonia; on the exterior of one of the halves, a thin layer of urate of ammonia has been deposited.

A f 6. The nucleus of this calculus consists of impure uric acid surrounded by a layer of urate with oxalate of lime; the outer coat consists of phosphate of lime. "From Dr. Groenvelt by Mr. Mason."—*Sloanian MS. Catalogue.* *British Museum,* 1809.

A f 7. Three calculi from the same bladder, having flattened surfaces produced by contact against one another.

The nucleus consists of uric acid, surrounded by urate of ammonia; the exterior of phosphate of lime, with some carbonate of lime and urate of ammonia. *Presented by Thomas Keate, Esq.,* 1811.

A f 8. A large pyriform calculus weighing 7½ ounces, with the following notice in the Sloanian MS. Catalogue:—"A stone drawn from a Woman's bladder, who died after the operation: given to me by Mr. Hucks."

Crystalline uric acid, disposed in the form of radiating fibres, surrounded by compact uric acid, around which is a layer of urate of ammonia mixed with uric acid and urate of lime; the whole is coated by the mixed phosphates. *British Museum,* 1809.

A f 9. A section of a large oblong calculus, the nucleus of which consists of uric acid; around this alternating layers of urate of ammonia and the mixed phosphates, and the whole is surrounded by crystallized phosphate of magnesia and ammonia. *British Museum,* 1808.

A f 10. "Five small rounded calculi and the fragments of a sixth. From a person 52 years of age."

Uric acid thinly coated by the fusible calculus; between these is a narrow layer of urate of ammonia mixed with urate of lime.

Presented by Sir E. Home, Bart., 1816.

A f 11. Three irregularly-shaped calculi, consisting of compact laminated uric acid, surrounded by a thin layer of urate of ammonia, and partially coated by the mixed phosphates. *Mus. Taunton.*

A f 12. Calculus removed from the bladder of Mrs. Alexander, ætat. 38; operation performed by Mr. Liston. The patient recovered.

The general figure of this calculus is pyriform, with one of its sides flattened and nearly smooth, probably from having been in contact with the bladder; the other is rounded, rough and indented, resembling the surface of a madrepore.

It consists principally of the mixed phosphates, containing a large proportion of the triple phosphate. These have been deposited upon a small nucleus of uric acid surrounded by urate of ammonia. The thin grey layers alternating with the phosphates, also consist of urate of ammonia. *Mus. Liston*, 1842.

A f 13. An oval calculus, measuring one inch in its greatest diameter. This specimen was removed from the bladder of a female, aged fifty-seven, by dilating the urethra. The nucleus consists of an irregular deposit of uric acid in the form of semi-crystalline grains. It is surrounded by a layer of urate of ammonia, and upon this is deposited the fusible compound. *Presented by Dr. U. Cumin*, 1842.

A g. *Uric Acid. Oxalate of Lime. Uric Acid.*

A g 1. A large oblong calculus "taken out of the bladder of Mr. Samuel Bryan, Nov. 2, 1682." Its weight is rather more than 10 ounces troy, and it measures through each of its respective axes, 3½, 2½, and 2 inches. The greater part of this calculus consists of compact laminated uric acid, which has been deposited upon a well defined oxalate of lime calculus, having a small nucleus of nearly pure uric acid.

Presented by Dr. Hawkins, 1841.

A h. *Uric Acid. Oxalate of Lime. Urate of Ammonia.*

Of this variety of calculus there is no specimen in the Museum.

A i. *Uric Acid. Oxalate of Lime. Earthy Phosphates.*

A i 1. A section of a calculus, much spiculated on its surface, together with three large and several small calculi.

This specimen has the following memorandum by Mr. Hunter: "Cut by Mr. Nourse at St. Bartholomew's Hospital, 1749. The small stones came away through the wound."

The central part of this calculus is composed of uric acid mixed with a considerable proportion of urate of ammonia, around which is pure white oxalate of lime; the whole is coated by pure phosphate of lime, compact, semitransparent, and fusible. The other calculi consist principally of oxalate of lime. *Hunterian.*

A i 2. Nucleus, uric acid mixed with the earthy phosphates. It is surrounded by an irregular layer of light-coloured oxalate of lime; the exterior consists of the mixed phosphates. *British Museum*, 1809.

A i 3. Uric acid surrounded by a narrow layer of oxalate of lime with urate of ammonia, and the whole coated by the mixed phosphates.
Presented by Thomas Keate, Esq., 1811.

A i 4. A section of a large oblong calculus, composed of alternating layers of uric acid, and of impure oxalate of lime, surrounded by the mixed phosphates. *Presented by John Gunning, Esq.*, 1816.

A k. *Calculi consisting of four or more Deposits, having a nucleus of Uric Acid.*

A k 1. A small calculus, having some resemblance in shape to a calabash, being divided into two unequal portions by a circular contraction. (Vide Plate III. figs. 3, 4.)

Impure uric acid, surrounded by uric acid and urate of ammonia; upon this is deposited phosphate of lime, with a little phosphate of magnesia and ammonia; its exterior is partially coated by pure oxalate of lime. *Presented by Dr. Power*, 1821.

SERIES II.

CALCULI OF WHICH THE NUCLEUS OR PRIMARY DEPOSIT CONSISTS OF URATE OF AMMONIA.

CALCULI consisting of urate of ammonia are always of a small size, few specimens exceeding an inch in length. They are usually of a flattened ovoid figure, with a smooth external surface. Their colour is subject to little variation, being of a brownish grey or clay colour, with frequently a tinge of green. These calculi are exceedingly brittle, and their fracture exhibits a compact fine earthy texture; when divided, they are seen to consist of concentric layers which are so thin and closely arranged as to give them a dense and homogeneous appearance: the layers in general separate readily from each other. (Vide Plate V. fig. 7.)

Urate of ammonia, though it very frequently forms the nucleus of a concretion, seldom constitutes an entire calculus. In this Collection, the calculi, consisting solely of urate of ammonia, are in the proportion of not more than one in fifty; but the number of those in which it forms the original deposit, is nearly one-third of the whole.

In its pure state this calculus is almost peculiar to early life, being seldom, if ever, found after puberty; its formation is always attended by great constitutional disturbance, with symptoms of nervous irritation*.

The urate of ammonia calculus when heated before the blow-pipe flies to

* Prout on Stomach and Urinary Diseases.

pieces, often with great violence; it then consumes away in a similar manner to the uric acid calculus, but generally leaves a more copious ash, resulting from the decomposition of some urate or oxalate of lime, which this calculus almost always contains; in some instances the residual ash is fusible from its containing the mixed phosphates*.

In most of its other chemical properties this calculus resembles that of uric acid; it is, however, more soluble in water, and in the carbonated alkalies. From its boiling aqueous solution, the urate of ammonia precipitates on cooling in the form of white flocculi, which appear under the microscope, either as an amorphous powder, or as little stellated tufts of crystals. The presence of ammonia may be shown by the abundant evolution of that gas, when the calculus is digested in a boiling solution of potass: also if it be heated for a few minutes in dilute muriatic acid, muriate of ammonia is formed, and may be rendered evident by the clear solution causing with the soluble salts of platina a precipitate of the yellow chloride of platina and ammonia.

From its alkaline solution uric acid is precipitated on the addition of an acid.

The urate of ammonia calculus was first described by Fourcroy and Vauquelin† about the year 1793: its title to be regarded as a distinct species of calculus was, however, considered doubtful‡ until the year 1820, when its existence as such was fully established by Dr. Prout§.

* The property of decrepitating on the application of heat, is very characteristic of this calculus, and appears to depend upon the sudden evolution of ammonia from a compact body. If a portion of the calculus be cautiously heated in a glass tube, water alone is at first given off, decrepitation then takes place, and at the same moment ammonia is freely evolved. When urate of ammonia is in a loose and porous state, as in the excrement of serpents, the power of decrepitation is lost, the necessary condition, compactness of structure, being absent. The only other calculi which occasionally possess a similar power, are some prostatal calculi, and some species of concretions from animals; in these it probably depends upon the expansion of films of animal matter interposed between the earthy layers of the calculus.

† *Ann. de Chem. et Phys.*, tom. xvi.

‡ Phil. Trans., vol. xcviii. p. 231. Marcet on the Chemical History, &c. of Calculous Diseases.

§ Medico-Chir. Trans., vol. x. p. 389.

B. *Urate of Ammonia.*

B 1. Half a small oval calculus, from a girl 7 years old, 1796.
Urate of ammonia mixed with oxalate of lime.
Presented by Everard Home, Esq., 1807.

B 2. Half a small calculus, consisting of urate of ammonia with a thin layer of the mixed phosphates immediately surrounding the nucleus.
Presented by Sir Anthony Carlisle, 1821.

B 3. A calculus "taken from the pelvis of the right kidney of a child four months old."
Urate of ammonia, nearly pure. *Hunterian.*

B 4. The section of a small calculus; the nucleus lost.
Urate of ammonia with a large proportion of oxalate of lime.
Hunterian.

B 5. A very small calculus, consisting of urate of ammonia slightly coated in parts by the mixed phosphates. *Hunterian.*

B 6. A small oval calculus, consisting principally of urate of ammonia.
Hunterian.

B 7. A calculus composed of urate of ammonia, containing thin layers of the mixed phosphates. *Presented by Sir Wm. Blizard*, 1819.

B 8. A section of a calculus, consisting of urate of ammonia mixed with urate of lime. *Hunterian.*

B 9. Fragments of an urate of ammonia calculus, some of the layers of which are of a light pink colour. *Presented by Mr. Long's Executors*, 1818.

B 10. Urate of ammonia with a little urate of lime. *Hunterian.*

B 11. A section of a small urate of ammonia calculus.

Presented by Sir Wm. Blizard, 1819.

B 12. A small calculus consisting of impure urate of ammonia.

Presented by W. Lynn, Esq., 1827.

B 13. A small urate of ammonia calculus, which was voided by the urethra of a female child, aged sixteen months.

Presented by Dr. U. Cumin, 1842.

B 14. Urate of ammonia, uric acid, and the mixed phosphates deposited apparently upon some animal matter which has disappeared. *Hunterian.*

B a. *Urate of Ammonia. Uric Acid.*

B a 1. A large calculus, with the following history from the Sloanian Catalogue:—

"A kidney-stone, weighing $7\frac{1}{2}$ ounces when taken out of a patient of Dr. Slare's, who gave it me."—*Sloanian MS. Catalogue.*

Nucleus urate of ammonia, the remainder uric acid nearly pure: the exterior is mixed with a little oxalate and phosphate of lime, and has an earthy and porous texture. (Vide Plate V. fig. 10.)

British Museum, 1809.

B a 2. An oval calculus, consisting of nearly pure uric acid deposited upon a small nucleus of urate of ammonia, mixed with a little oxalate of lime.

British Museum, 1809.

B a 3. A flattened oval calculus.

Uric acid mixed with a little oxalate and phosphate of lime, upon a nucleus of urate of ammonia. *Hunterian.*

B a 4. Uric acid upon a nucleus of urate of ammonia.

Presented by Sir Wm. Blizard, 1819.

B a 5. Impure uric acid upon a nucleus of urate of ammonia. *Hunterian.*

B a 6. A small oblong calculus, "extracted from a Boy four years of age, 1783."

Nucleus, urate of ammonia with urate and oxalate of lime, remainder uric acid. *Presented by Sir Wm. Blizard*, 1819.

B a 7. Urate of ammonia surrounded by uric acid with a trace of oxalate of lime. *Presented by Wm. Lynn, Esq.*, 1827.

B a 8. An oblong calculus (about 2 ounces in weight), with the following memorandum by Sir Wm. Blizard:—"From Mrs. Bliss."

Uric acid upon a nucleus of urate of ammonia mixed with uric acid and oxalate of lime. *Presented by Sir Wm. Blizard*, 1811.

B a 9. Urate of ammonia mixed with uric acid and oxalate of lime, surrounded by uric acid mixed in various proportions with oxalate of lime.

British Museum, 1809.

B a 10. Uric acid upon a nucleus of urate of ammonia.

British Museum, 1809.

B a 11. A section of a calculus, consisting of uric acid upon a nucleus of urate of ammonia.

B a 12. A section of a large uric acid calculus, the nucleus of which consists principally of urate of ammonia. *Hunterian*.

B a 13. Uric acid upon a nucleus of urate of ammonia.

Presented by Everard Home, Esq., 1807.

B a 14. Nucleus, urate of ammonia; remainder uric acid nearly pure: a few crystals of oxalate of lime have been deposited on the exterior.

Presented by Thos. Keate, Esq., 1811.

B a 15. A section of a calculus consisting of uric acid upon a nucleus of urate of ammonia.

B a 16. Fragments of an uric acid calculus with a nucleus of urate of ammonia containing some oxalate of lime.

Presented by Sir Wm. Blizard, 1819.

B a 17. A small calculus consisting of alternating layers of urate of ammonia and of uric acid. Presented to Mr. Hunter by M. Loutherbourg.

Hunterian.

B a 18. A small calculus.

Urate of ammonia with oxalate of lime, surrounded by uric acid, containing at the exterior a little urate of ammonia.

Presented by Sir Wm. Blizard, 1819.

B a 19. An oblong calculus, with the following memorandum by Mr. R. Haynes: —"Extracted from the urethra, just behind the scrotum, of a lad eight years of age, at St. George's Hospital."

Urate of ammonia with oxalate of lime, coated by nearly pure uric acid. *Hunterian.*

B a 20. A calculus from the human urinary bladder.

Uric acid, having a nucleus of urate of ammonia containing oxalate of lime. *Presented by Wm. Lynn, Esq.*, 1827.

B a 21. A section of an uric acid calculus, similar in form to that figured in Plate III. fig. 4, but much larger. The larger portion of this calculus is marked with a shallow groove, which has been probably produced by the current of urine in its passage from the ureters. It contains a small nucleus of urate of ammonia. *British Museum.*

B b. *Urate of Ammonia. Oxalate of Lime.*

The oxalic acid diathesis appears in many instances to be preceded by the deposition of urate of ammonia. In some cases the transition from the one to the other is abrupt and well defined; but in general they pass insensibly into each other, the quantity of oxalate of lime mixed with the urate of ammonia continually increasing as the calculus enlarges in size, until the characters of the former deposit are completely lost in those of oxalate of lime. The nuclei of all these calculi decrepitate violently when heated: in some cases they contain small quantities of urate of lime.

B b 1. A mulberry or oxalate of lime calculus upon a nucleus of urate of ammonia mixed with oxalate of lime. *British Museum*, 1809.

B b 2. A mulberry calculus, with the following notice in the Sloanian MS. Catalogue:—"From Dr. Groenvelt to Mr. Mason."

Oxalate of lime upon a nucleus of urate of ammonia mixed with oxalate of lime. *British Museum,* 1809.

B b 3. Urate of ammonia with a little oxalate of lime, coated by oxalate of lime. *British Museum,* 1809.

B b 4. Pure oxalate of lime upon a small nucleus of urate of ammonia containing oxalate of lime. The white layers which give to this calculus its very beautiful appearance consist principally of phosphate of lime. Vide Plate V. fig. 5. *Hunterian.*

B b 5. Oxalate of lime upon a nucleus of urate of ammonia. *British Museum,* 1809.

B b 6. Urate of ammonia surrounded by a narrow layer of oxalate of lime.

"From Dr. Groenvelt by Mr. Mason."—*Sloanian MS. Catalogue.* *British Museum,* 1809.

B b 7. A calculus resembling a mulberry, both in form and size.

Oxalate of lime upon a nucleus of impure urate of ammonia. *Hunterian.*

B b 8. "A small grey-coloured calculus spinosus, with large prickles. From Dr. Groenvelt by Mr. Mason."—*Sloanian MS. Catalogue.*

Nucleus, urate of ammonia with oxalate of lime: the white layer consists of oxalate and carbonate of lime, the crystals on the exterior of pure oxalate of lime. *British Museum,* 1809.

B b 9. An urinary calculus, extracted by operation at St. George's Hospital, by Sir Everard Home. It was of a very dark colour, nearly black, when extracted, which colour it still retains.

Urate of ammonia mixed with a small quantity of oxalate of lime and of the phosphates, surrounded by crystallized oxalate of lime. *Presented by Sir Everard Home, Bart.,* 1821.

B b 10. Three small calculi consisting of urate of ammonia surrounded by oxa-

late of lime. These calculi were probably not taken from the same bladder, but are similar in composition.

Presented by Sir Anthony Carlisle, 1821.

B b 11. Oxalate of lime upon a nucleus of urate of ammonia mixed with oxalate of lime. The external surface is studded with minute crystals of oxalate of lime. *Presented by John Gunning, Esq.*, 1822.

B b 12. Urate of ammonia surrounded by oxalate of lime.

Presented by John Gunning, Esq., 1816.

B b 13. A small calculus, having three processes.

Urate of ammonia with a little oxalate of lime, surrounded by pure oxalate of lime. *Hunterian.*

B b 14. An oxalate of lime calculus, having the appearance of being made up of small agglutinated grains. The nucleus consists of urate of ammonia mixed with oxalate of lime.

Presented by Mr. Long's Executors, 1818.

B b 15. Oxalate of lime upon a nucleus of urate of ammonia.

Presented by Sir Wm. Blizard, 1819.

B b 16. Fragments of a calculus.

Oxalate of lime, with a nucleus of urate of ammonia.

Presented by Sir Wm. Blizard, 1819.

B b 17. A small calculus, with the following notice:—"From the child last cut by Mr. Grindall."

Urate of ammonia mixed with oxalate of lime, having crystals of pure oxalate of lime on its exterior.

Presented by Sir Wm. Blizard.

B b 18. Pure oxalate of lime surrounding a nucleus of urate of ammonia mixed with oxalate of lime. *Hunterian.*

B b 19. Oxalate of lime upon a nucleus of urate of ammonia.

Presented by Sir Wm. Blizard, 1819.

B b 20. A small oval calculus; the nucleus consists of urate of ammonia with oxalate of lime; it is surrounded by a mixture of oxalate and phosphate

of lime with urate of ammonia, and is coated by pure white oxalate of lime. *Presented by Wm. Lynn, Esq.*, 1827.

B b 21. Half a calculus, consisting of urate of ammonia mixed with a little oxalate of lime, coated by pure oxalate of lime disposed in the form of radiating fibres, and having minute crystals of the same on its outer surface. *Hunterian.*

B b 22. Urate of ammonia mixed with oxalate of lime, coated by crystallized oxalate of lime. *Hunterian.*

B b 23. Urate of ammonia mixed with oxalate of lime, surrounded by oxalate of lime. *Presented by Sir Wm. Blizard*, 1819.

B b 24. Nucleus, urate of ammonia with oxalate of lime; remainder nearly pure oxalate of lime. *Presented by Dr. Power*, 1829.

B b 25. A small calculus consisting of impure urate of ammonia, coated by oxalate of lime and uric acid in alternating layers.
Presented by Sir Wm. Blizard, 1819.

B b 26. A small tuberculated calculus.
Urate of ammonia with a little oxalate of lime, coated by pure oxalate of lime. *Presented by Sir Anthony Carlisle*, 1821.

B b 27. " A small oval calculus from a Boy at St. George's, 1783."
Urate of ammonia with oxalate of lime, coated by white crystallized oxalate of lime. *Hunterian.*

B b 28. Urate of ammonia coated by oxalate of lime.
Presented by Wm. Lynn, Esq., 1827.

B b 29. A very small broken calculus.
Urate of ammonia with oxalate of lime, thinly coated by oxalate of lime. *Presented by Sir Wm. Blizard*, 1819.

B b 30. A section of a small oval calculus, the central portion of which consists of nearly pure urate of ammonia, while the exterior is composed of oxalate of lime mixed with a small quantity of urate of ammonia.
This calculus forms a good illustration of the gradual transition

from the urate of ammonia deposit to that of oxalate of lime. It does not contain any urate of lime.

Presented by W. T. Brande, Esq., 1841.

B b 31. A section of a small oblong calculus consisting of urate of ammonia coated by a thin layer of crystalline oxalate of lime. *Hunterian.*

B c. *Urate of Ammonia. Earthy Phosphates.*

Urate of ammonia not only forms the nucleus of the following calculi, but very frequently occurs in the form of thin layers, irregularly alternating with the phosphates. It is also present mixed in variable quantities with the other ingredients of the calculus.

B c 1. Urate of ammonia surrounded by the mixed phosphates, the latter containing irregular layers of urate of ammonia. (Plate VI. fig. 1.)

Presented by H. L. Thomas, Esq., 1822.

B c 2. A calculus whose surface is much spiculated.

Urate of ammonia with oxalate of lime, coated by phosphate of lime with phosphate of magnesia and ammonia.

Presented by Sir Wm. Blizard, 1819.

B c 3. An oblong kidney-shaped calculus from the human bladder.

Urate of ammonia mixed with a considerable quantity of oxalate of lime, surrounded by the fusible calculus.

Presented by Thomas Keate, Esq., 1811.

B c 4. A human vesical calculus; purchased at the sale of the collection of the late Dr. Wright of Lichfield.

Urate of ammonia with oxalate of lime, surrounded by the mixed phosphates. *Presented by Sir Everard Home*, 1821.

B c 5. "A stone cut out of the bladder of a Boy of six years old, in the form of a penis with its glans."—*Sloanian MS. Catalogue.*

The bulbous portion of this calculus consists of urate of ammonia surrounded by the mixed phosphates: it was probably lodged in the prostatic portion of the urethra, while the cylindrical process, consisting of the phosphates alone, projected into the bladder.

British Museum, 1831.

B c 6. Two calculi "extracted from the bladder of a Boy two years and a half old, June 1779."

Urate of ammonia surrounded by the mixed phosphates: the extremity of each calculus is surmounted by a mass of the phosphates.

Presented by Sir Wm. Blizard.

B c 7. A calculus removed from the bladder of a Man at St. George's Hospital: the broken part is said to have adhered to the bladder.

Urate of ammonia with a considerable quantity of oxalate of lime, surrounded by the fusible calculus.

Presented by Thomas Keate, Esq., 1811.

B c 8. Ten calculi, with the following history in the Sloanian MS. Catalogue: "Several soft whitish stones levigated against each other by rubbing, from Mr. Paul by Mr. Ranby." These calculi were most probably taken from a cyst in the prostate gland.

Mixed phosphates, upon a nucleus of urate of ammonia mixed with oxalate of lime and the phosphates. *British Museum.*

B c 9. Three large calculi with polished articulating surfaces, from having been closely in contact with each other: these calculi formed a nearly spherical calculus, the exterior of which is channelled by a groove for the passage of the urine: each of these portions has a nucleus of urate of ammonia mixed with uric acid and the earthy phosphates: the remainder consists of phosphate of magnesia and ammonia, containing a small quantity of phosphate of lime. At the exterior the triple phosphate is beautifully crystallized; in other parts it is massive, semitransparent, and resembles alabaster. (Vide Plate VII.)

Presented by H. L. Thomas, Esq., 1822.

B c 10. A very large vesical calculus, formerly in the possession of Wm. Cheselden, Esq.

Fusible calculus, containing a small nucleus and irregular layers of urate of ammonia. This calculus illustrates very well the manner in which urate of ammonia precedes and alternates with the phosphates.

Presented by Benjamin Cooper, Esq., 1829.

B c 11. Urate of ammonia, surrounded by the mixed phosphates.

B c 12. Two calculi taken from the body of Miles Peter Andrews, Esq., M.P. They were known to be present in the bladder twenty years before his death, which happened in 1814.

Urate of ammonia mixed with uric acid, oxalate of lime, and the mixed phosphates, surrounded by the fusible calculus, in which are thin dark layers of oxalate of lime.

Presented by James Wilson, Esq, 1821.

B c 13. An oblong calculus, and a smaller one with which it has been in contact; both have smooth articulating surfaces.

Urate of ammonia coated by the mixed phosphates.

Presented by Sir Wm. Blizard, 1811.

B c 14. Urate of ammonia with the mixed phosphates surrounded by the fusible calculus. *Presented by Sir Wm. Blizard*, 1819.

B c 15. A calculus removed from a Boy seven years of age, 1819.

Urate of ammonia with oxalate of lime, surrounded by phosphate of lime mixed with a large proportion of urate of ammonia and of oxalate of lime. *Presented by Sir Wm. Blizard*, 1819.

B c 16. A small calculus consisting of urate of ammonia with urate and oxalate of lime; it is thinly coated by the mixed phosphates.

Presented by Sir Wm. Blizard.

B c 17. Four small calculi consisting of urate of ammonia thinly coated by the mixed phosphates. *Presented by William Lynn, Esq.*, 1827.

B c 18. Mixed phosphates upon a minute nucleus of impure urate of ammonia.

Hunterian.

B c 19. A section of a small calculus composed of urate of ammonia coated by the mixed phosphates. *Hunterian.*

B c 20. A section of a calculus consisting of urate of ammonia with oxalate of lime, surrounded by phosphate of magnesia and ammonia with some phosphate of lime. *Hunterian.*

B c 21. A small calculus, having a triangular figure.

Urate of ammonia surrounded by the fusible calculus.

Presented by John Gunning, Esq., 1816.

B c 22. Urate of ammonia with oxalate and phosphate of lime, coated by phosphate of lime containing a small quantity of phosphate of magnesia and ammonia. *Presented by E. Home, Esq.*, 1807.

B c 23. Urate of ammonia, surrounded by alternate layers of phosphate of lime and of urate of ammonia; it is coated by a layer of pure phosphate of lime. *Presented by Wm. Lynn, Esq.*, 1827.

B c 24. A small oval calculus.

Urate of ammonia, surrounded by alternate layers of urate of ammonia and of the mixed phosphates.

Presented by Sir Wm. Blizard, 1819.

B c 25. "Three calculi taken from the same bladder, after death."

Urate of ammonia, surrounded by alternate layers of urate of ammonia and of the mixed phosphates; the phosphates predominate at the exterior. *British Museum*, 1809.

B c 26. A nucleus, and fragments of the external crust of a calculus from "a Girl four years old."

Nucleus, urate of ammonia with a little oxalate of lime, the rest mixed phosphates. *Hunterian.*

B c 27. Nine calculi, having flattened articulating surfaces, produced by rubbing against one another.

Urate of ammonia coated by the mixed phosphates. *Hunterian.*

B c 28. One half of a calculus, removed by the high operation by Mr. Copland Hutchison. The patient recovered.

Urate of ammonia with a little oxalate of lime, surrounded first by the fusible calculus, and next by a mixture of phosphate and carbonate of lime. *Presented by A. C. Hutchison, Esq.*, 1825.

B c 29. Urate of ammonia coated by the fusible calculus, the portion immediately around the nucleus is mixed with a considerable quantity of urate of ammonia.

B c 30. Nucleus, urate of ammonia with a large proportion of oxalate of lime; exterior, the phosphates mixed in various proportions.

B c 31. "A flat middling-sized stone rough on the outside, from Mr. Ranby." —*Sloanian MS. Catalogue.*

Urate of ammonia surrounded by the phosphates.

British Museum, 1809.

B c 32. Three small angular calculi, extracted from the same bladder.

The nuclei of these calculi consist of urate of ammonia mixed with urate and oxalate of lime, the remainder of alternate layers of the fusible calculus and of urate of ammonia, of which latter substance the exterior layer is composed. *Presented by Sir Wm. Blizard*, 1821.

B c 33. Two small calculi, supposed to be from the same bladder.

Urate of ammonia mixed with phosphate of magnesia and ammonia and phosphate of lime, surrounded by the fusible calculus containing thin layers of urate of ammonia.

Presented by Sir Wm. Blizard, 1819.

B c 34. A section of a small calculus.

Urate of ammonia mixed with oxalate and a little phosphate of lime, thinly coated by the mixed phosphates.

Presented by John Gunning, Esq., 1816.

B c 35. Urate of ammonia with a little oxalate of lime, coated by the mixed phosphates. *Hunterian.*

B c 36. A calculus which has evidently been in contact with another.

Urate of ammonia surrounded by the phosphates.

Presented by John Gunning, Esq., 1816.

B c 37. A section of a small calculus.

Fusible calculus containing layers of urate of ammonia formed upon a nucleus of the latter substance.

Presented by John Gunning, Esq., 1816.

B c 38. A section of a calculus, and some smaller irregular concretions from the same bladder.

Urate of ammonia mixed with uric acid, and with urate and oxalate of lime, coated by the fusible calculus. *Hunterian.*

B c 39. "From the urethra of Sir George Howard, Aug. 1805."

Urate of ammonia with a little oxalate of lime, coated by the phosphates. *Presented by T. Keate, Esq.*, 1811.

B c 40. Urate of ammonia surrounded by the fusible calculus.

Presented by Sir Wm. Blizard, 1829.

B c 41. Urate of ammonia coated by the mixed phosphates.

Presented by Sir Wm. Blizard, 1819.

B c 42. Urate of ammonia surrounded, and capped by the mixed phosphates.

Presented by Sir Anthony Carlisle, 1821.

B c 43. Half a calculus composed of urate of ammonia with oxalate of lime, coated by the mixed phosphates.

Presented by John Gunning, Esq., 1816.

B c 44. A calculus of an oval form, and another slender and very much elongated.

Nucleus, urate of ammonia, surrounded by urate of ammonia with phosphate of lime, and coated by the fusible calculus. *Hunterian.*

B c 45. "From Dr. Groenvelt."—*Sloanian Catalogue.*

Urate of ammonia mixed with a little oxalate and phosphate of lime, coated by layers of urate of ammonia containing phosphate and carbonate of lime. *British Museum,* 1809.

B c 46. A small calculus, with the following memorandum by Mr. Hunter:— "Cut from a child a year and a half old, at St. George's Hospital, by J. Hunter."

Urate of ammonia, surrounded by alternate layers of the mixed phosphates and of urate of ammonia. *Hunterian.*

B c 47. Two angular calculi with articulating surfaces from having been in contact with other calculi: they are probably from the same bladder. "From Dr. Groenvelt."—*Sloanian MS. Catalogue.*

Mixed phosphates upon a nucleus of urate of ammonia.
British Museum, 1809.

B c 48. Urate of ammonia mixed with uric acid and a little urate of lime, surrounded by the fusible calculus. *Presented by Sir Anthony Carlisle*, 1821.

B c 49. Urate of ammonia, coated by the phosphates mixed with urate of ammonia. *British Museum*, 1809.

B c 50. A small oblong calculus.
Urate of ammonia, coated by the fusible calculus.
Presented by Sir Wm. Blizard, 1819.

B c 51. An irregularly-shaped calculus, with a small cylindrical portion which has been apparently broken off. It consists of urate of ammonia surrounded by the fusible calculus.
Presented by Sir Wm. Blizard, 1819.

B c 52. Portions of a fractured calculus.
Mixed phosphates upon a nucleus of urate of ammonia.
Presented by Sir Wm. Blizard, 1819.

B c 53. A small oval calculus, of a lilac colour externally.
Urate of ammonia with oxalate of lime, surrounded by phosphate of lime mixed with a little triple phosphate: the exterior lilac-coloured layer consists principally of urate of ammonia. *Hunterian.*

B c 54. A conical-shaped calculus.
Urate of ammonia with oxalate of lime, surrounded by the mixed phosphates with layers of urate of ammonia. The process at one extremity consists chiefly of phosphate of magnesia and ammonia.
Hunterian.

B c 55. A small oblong calculus.
Urate of ammonia coated by the mixed phosphates.
Presented by John Gunning, Esq., 1816.

B c 56. Urate of ammonia containing a small quantity of oxalate of lime, surrounded by the fusible calculus; a thin layer of oxalate of lime has been deposited upon the exterior. *Presented by Sir Wm. Blizard*, 1819.

B c 57. A section of a calculus, composed of the mixed phosphates upon a nucleus of urate of ammonia. *Hunterian.*

B c 58. Mixed phosphates upon a small nucleus of urate of ammonia. *Presented by Dr. Power.*

B c 59. Mixed phosphates upon a nucleus of urate of ammonia. *Presented by Sir Wm. Blizard,* 1819.

B c 60. Urate of ammonia coated by the fusible calculus. *Presented by Sir Wm. Blizard,* 1819.

B c 61. Two small calculi, apparently from the same bladder, consisting of urate of ammonia coated by the mixed phosphates.

B c 62. An oblong calculus of a crescentic figure, composed of the fusible calculus deposited upon a small excentric nucleus of urate of ammonia. Delineated and described Plate VI. fig. 2. *Hunterian.*

B c 63. A large white calculus, which was removed by Mr. Liston from the bladder of James Black, ætat. 64. The patient's recovery was very favourable, with the exception of hemorrhage from the urethra and wound, occurring twelve days after the operation. He died of ileus nearly six weeks after the operation.

The surface of this calculus is crystalline, and at one point irregularly nodulated: it measures 3 inches, 2½ inches, and 1¼ inch through each of its respective axes, and is of a regular oval figure.

Crystalline phosphate of magnesia and ammonia mixed with some phosphate of lime, surrounding a small nucleus of urate of ammonia. *Mus. Liston,* 1842.

B c 64. An oblong calculus, consisting of impure urate of ammonia, surrounded by the earthy phosphates mixed with carbonate of lime. *Presented by Dr. U. Cumin,* 1842.

B d. *Urate of Ammonia. Uric Acid. Urate of Ammonia.*

B d 1. The nucleus and exterior part of this calculus consist of urate of ammonia mixed with traces of urate and oxalate of lime; between these is nearly pure uric acid. *British Museum*, 1809.

B d 2. A small angular calculus.

Nucleus, urate of ammonia with a little oxalate of lime, surrounded by uric acid, and lastly, by urate of ammonia also mixed with some oxalate of lime. *Presented by John Gunning, Esq.*, 1816.

B d 3. A small oval calculus, contained in an oval silver box, with the family arms engraved on the lid, and the following inscription on the outside: —"Deliverance was sent from God to Francis Godman, the 26th September 1687, in the 7th year and 10th day of his age."

Nucleus, urate of ammonia with traces of urate and oxalate of lime; upon this uric acid has been deposited, and the whole is surrounded by urate of ammonia containing the mixed phosphates.

Presented by F. G. Capell, Esq., 1823.

B d 4. A flattened oval calculus, consisting of nearly pure uric acid, surrounded by a layer about a quarter of an inch in thickness of urate of ammonia mixed with urate and oxalate of lime. The nucleus, which is small, has a similar composition to that of the outer coat.

Presented by J. G. Andrews, Esq., 1841.

B d 5. An oblong calculus, the composition of which is very similar to the preceding: its exterior is partially coated by a deposition of the phosphates.

This calculus was taken after death from the bladder of a Boy, aged four years. He had symptoms of stone in the bladder about two years, was much emaciated, had a bad appetite, and the rectum, from frequent prolapsus, was enlarged and ulcerated. About a month before he died, the secretion of urine was very much diminished; his head was much affected, but he suffered little pain; his tongue was furred, and he

vomited constantly after taking food. On examination both kidneys were found enlarged, with very slight traces of healthy structure; they had a white appearance, as if from scrofulous deposit, and contained some pus. In the right kidney the infundibula were ulcerated in several places. Both ureters were dilated to the size of the intestinum ileum. The bladder was contracted and thickened, but not ulcerated.

Presented by J. Swan, Esq., 1842.

B e. *Urate of Ammonia. Uric Acid. Oxalate of Lime.*

B e 1. A section of a calculus consisting of urate of ammonia surrounded by impure uric acid, and coated by oxalate of lime.

B e 2. Nucleus, urate of ammonia with oxalate of lime surrounded by uric acid; a thin layer of urate of ammonia with oxalate of lime coats the whole, and upon this is deposited perfect crystals of oxalate of lime.

Hunterian.

B e 3. A small calculus consisting principally of uric acid; the nucleus is composed of urate of ammonia mixed with oxalate of lime, and crystals of oxalate of lime are scattered over its exterior. *Hunterian.*

B e 4. " A small flat oval stone, with an upper blackish brown coat like coagulated blood. From Dr. Groenvelt by Mr. Mason."—*Sloanian MS. Catalogue.*

Nucleus, urate of ammonia with oxalate of lime, surrounded first by uric acid; secondly, by a thin layer of urate of ammonia containing oxalate and phosphate of lime; and lastly, by oxalate of lime.

British Museum, 1809.

B f. *Urate of Ammonia. Uric Acid. Earthy Phosphates.*

B f 1. A large calculus, the nucleus of which consists of urate of ammonia with oxalate of lime; remainder uric acid, becoming very pure and compact as it approaches the exterior; a thin layer of the fusible calculus coats the whole. *Leverian Museum*, 1806.

B f 2. An irregularly-shaped vesical calculus, consisting of an oval portion with a cylindrical process attached at an obtuse angle to one of its extremities. The bulbous or oval portion consists of urate of ammonia surrounded by uric acid and is partially coated by the phosphates. This portion was probably lodged in the prostatic portion of the urethra, while the long cylindrical process attached to it projected into the bladder. The latter consists of the fusible calculus with layers of uric acid, and its summit is capped with nearly pure phosphate of magnesia and ammonia. (Vide Plate VIII. figs. 13, 14.) *British Museum.*

B f 3. Uric acid with a trace of oxalate of lime, thinly coated by the fusible calculus. Nucleus, urate of ammonia with oxalate of lime. *Hunterian.*

B f 4. Part of a calculus which has a very distinct nucleus, "from Master Shergold."

Urate of ammonia with oxalate of lime, surrounded by impure uric acid, and a mixture of urate of ammonia, uric acid and the mixed phosphates. *Hunterian.*

B f 5. Nucleus, urate of ammonia with a little oxalate of lime, surrounded, first, by uric acid, and lastly, by the mixed phosphates with urate of ammonia. *British Museum*, 1809.

B f 6. "A calculus from the kidney of Sir George Howard." Vide B c 39 for a calculus taken from the urethra of the same gentleman.

Urate of ammonia with uric acid and a little oxalate of lime, surrounded by uric acid, and coated by the mixed phosphates.

Presented by Thomas Keate, Esq., 1811.

B g. *Urate of Ammonia. Oxalate of Lime. Uric Acid.*

B g 1. The nucleus of this calculus consists of urate of ammonia mixed with uric acid and a trace of oxalate of lime: upon this is deposited oxalate of lime, and the whole is coated by uric acid mixed with some urate of ammonia. (Vide Plate V. fig. 1.) *British Museum*, 1809.

B g 2. A large calculus taken after death from the bladder of Joseph Brooks, a private in the Berkshire militia in 1781.

The nucleus consists of urate of ammonia; around this is deposited a narrow layer of oxalate of lime; then uric acid mixed with oxalate of lime; and lastly, nearly pure uric acid. (Vide Plate VI. fig. 4.)

Presented by John Baker, Esq.

B g 3. A calculus which was perforated by Mr. Costello at Bristol: the patient afterwards came to London and was admitted into St. Bartholomew's Hospital, where he died, previous to any further operation being attempted. The perforation remains, except that it is closed at both ends by the subsequent deposits. (Vide Plate VI. fig. 3.)

Urate of ammonia with oxalate of lime, surrounded by oxalate of lime and by uric acid, between the layers of which crystals of the triple phosphate have been deposited; the exterior is coated by a thin layer of urate of ammonia.

B g 4. Urate of ammonia mixed with oxalate of lime, surrounded by a thin layer of oxalate of lime, and the whole coated by uric acid containing a little oxalate of lime.

"These stones are from the kidneys of a person who died of a suppression of urine; thought to have a paralysis of the kidneys. One kidney was filled with a stone, branched; and the other had the papillæ, tubuli urinarii, and pelvis full of other stones. By Mr. Ranby." —*Sloanian MS. Catalogue.* *British Museum*, 1809.

B g 5. A section of a calculus, the nucleus of which consists of urate of ammonia mixed with a considerable proportion of oxalate of lime and

some uric acid, around which is deposited crystallized oxalate of lime; the rest of the calculus is composed of impure uric acid.

British Museum, 1809.

B g 6. A small calculus "extracted from a Boy about twelve years of age, in September 1783."

The nucleus consists principally of urate of ammonia; upon this has been deposited, first, a layer of oxalate of lime, and lastly, uric acid.

Presented by Sir Wm. Blizard, 1819.

B g 7. A small nearly spherical calculus, "extracted from Mr. Churchill."

Nucleus, urate of ammonia mixed with oxalate of lime, surrounded by pure oxalate of lime; exterior uric acid.

Presented by Sir Everard Home, 1814.

B g 8. Nucleus, urate of ammonia mixed with oxalate of lime, surrounded by oxalate of lime; remainder uric acid. *Hunterian.*

B g 9. Half of a small calculus, the nucleus of which consists of urate of ammonia mixed with a little oxalate of lime; this is surrounded by a deposit, first, of oxalate of lime, and secondly, of impure uric acid. "From Dr. Groenvelt by Mr. Mason."—*Sloanian MS. Catalogue.*

British Museum, 1809.

B g 10. A small calculus, the composition of which is similar to the preceding.

Presented by Sir Wm. Blizard, 1819.

B g 11. Portions of a calculus.

Urate of ammonia, surrounded by oxalate of lime and coated by uric acid. *Hunterian.*

B h. *Urate of Ammonia. Oxalate of Lime. Urate of Ammonia.*

Of this variety of calculus the Museum possesses no specimen.

B i. *Urate of Ammonia. Oxalate of Lime. Earthy Phosphates.*

B i 1. The nucleus of this calculus consists of urate of ammonia mixed with oxalate of lime : it is surrounded, first, by nearly pure oxalate of lime, and lastly, by crystalline phosphate of lime disposed in the form of radiating fibres. *Presented by Wm. Lynn, Esq.*, 1827.

B i 2. A section of a spherical calculus.
Nucleus, urate of ammonia with a little oxalate of lime; upon this is deposited, first, oxalate of lime, and lastly, the mixed phosphates. *Hunterian.*

B i 3. Composition similar to the preceding. *Presented by Dr. Power*, 1821.

B i 4. Urate of ammonia with oxalate of lime, and nearly pure oxalate of lime in alternate layers, the whole being coated by the fusible calculus, having irregular deposits of the former substances mixed with it. *Presented by Sir Wm. Blizard*, 1819.

B i 5. A calculus, and the half of another, "from a Boy 6 years of age, with two strictures. He died in St. George's Hospital. When entire they weighed 6 drachms."
Oxalate of lime upon a nucleus of urate of ammonia, surrounded by the fusible calculus. *Presented by Everard Home, Esq.*, 1807.

B i 6. A section of a calculus, extracted from the bladder of a lad aged 16 at St. George's Hospital, 1798. It weighed 4 ounces 5 drachms.
Oxalate of lime deposited upon a nucleus of urate of ammonia, and surrounded by phosphate of magnesia and ammonia mixed with phosphate of lime. *Presented by Everard Home, Esq.*, 1807.

B i 7. Oxalate of lime coated by the phosphates; the nucleus consists of urate of ammonia mixed with oxalate of lime. *British Museum*, 1809.

B i 8. The nucleus of this calculus consists of urate of ammonia mixed with oxalate of lime; it is surrounded by oxalate of lime and is coated by

the mixed phosphates, containing urate of ammonia and a little carbonate of lime. *Presented by Sir Anthony Carlisle*, 1821.

B i 9. "A urinary calculus extracted at St. George's Hospital, Sept. 14, 1805."
Urate of ammonia surrounded by oxalate of lime, and coated by the fusible calculus. *Presented by Thomas Keate, Esq.*, 1811.

B i 10. A section of a large vesical calculus. "From Mr. Paul by Mr. Ranby." —*Sloanian MS. Catalogue.*
Composition similar to the preceding. *British Museum*, 1809.

B i 11. The nucleus of this calculus consists of urate of ammonia mixed with oxalate of lime, around which is a narrow layer of oxalate of lime; the exterior consists of the mixed phosphates. *Hunterian.*

B i 12. A section of a calculus "from a Man in Moorfields."—*Sloanian MS. Catalogue.*
The nucleus consists of urate of ammonia, around which is pure oxalate of lime: the whole is thinly coated by a mixture of phosphate and oxalate of lime.
This calculus is figured in Plate VI. fig. 5, and is a fine specimen of oxalate of lime deposited upon urate of ammonia.
British Museum, 1809.

B i 13. Nucleus, urate of ammonia with oxalate of lime, around this oxalate of lime with irregular layers of uric acid, the whole surrounded by phosphate of lime with some phosphate of magnesia and ammonia.
Presented by Mr. Long's Executors, 1818.

B i 14. A renal calculus of considerable size which occupied the pelvis of the kidney and beginning of the ureter of No. 939 E., Preparations in Spirit.
It consists principally of the mixed phosphates containing carbonate of lime, and is deposited upon an excentric nucleus of urate of ammonia, surrounded by a narrow layer of oxalate of lime.
Presented by Sir Wm. Blizard.

B i 15. A small oval calculus.

Nucleus, urate of ammonia with oxalate of lime; it is surrounded, first, by oxalate of lime, and lastly, by the fusible calculus.

Presented by Sir Wm. Blizard, 1819.

B i 16. "From Dr. Groenvelt by Mr. Mason."—*Sloanian MS. Catalogue.*

Oxalate of lime upon a nucleus of impure urate of ammonia, coated by the mixed phosphates. *British Museum*, 1809.

B i 17. "Removed from the bladder of a Boy 17 years of age, at St. George's Hospital, May 26, 1820. This was the first case of removal by the high operation without wounding the perinæum; the Boy soon recovered."

Oxalate of lime upon a nucleus of urate of ammonia, coated by a thin layer of the mixed phosphates.

Presented by Sir E. Home, with the foregoing memorandum, 1820.

B i 18. An irregular oval calculus "extracted from a Boy 14 years old, in St. George's Hospital."

Urate of ammonia mixed with uric acid, surrounded by oxalate of lime with urate of ammonia, and the whole thinly coated by the mixed phosphates. *Presented by Everard Home, Esq.*, 1807.

B i 19. An oblong calculus "from Mr. Paul by Mr. Ranby."—*Sloanian MS. Catalogue.*

Oxalate of lime surrounded by the phosphates; the nucleus consists of urate of ammonia with oxalate of lime. *British Museum*, 1809.

B i 20. Urate of ammonia mixed with oxalate of lime, surrounded by nearly pure oxalate of lime and coated by the mixed phosphates.

British Museum, 1809.

B i 21. Oxalate of lime coated by the mixed phosphates with carbonate of lime; nucleus, urate of ammonia with oxalate of lime.

Presented by Sir Wm. Blizard, 1819.

B i 22. Nucleus, urate of ammonia with oxalate of lime, surrounded by oxalate of lime and coated by a mixture of the phosphates and urate of ammonia. *British Museum*, 1809.

B i 23. Urate of ammonia, surrounded first, by oxalate of lime, and lastly, by the mixed phosphates.

"From Mr. Paul by Mr. Ranby."—*Sloanian MS. Catalogue.*

British Museum, 1809.

B i 24. "A calculus taken from a boy about 6 years old."

Nucleus, urate of ammonia with oxalate of lime, around this crystallized oxalate of lime; the whole coated by the mixed phosphates.

Hunterian.

B i 25. Nucleus, urate of ammonia, surrounded by oxalate of lime, and lastly, by the fusible calculus mixed with uric acid. *Hunterian.*

B i 26. A small calculus consisting of urate of ammonia with oxalate of lime, surrounded first, by oxalate of lime, and lastly, by the mixed phosphates. *Presented by Mr. Long's Executors*, 1818.

B i 27. A small oblong calculus about the size of a large almond, consisting of oxalate of lime upon a nucleus of impure urate of ammonia. The exterior consists of the phosphates, and only partially covers the calculus.

Hunterian.

B i 28. "A calculus extracted from the bladder of a boy aged 10 years, at the London Hospital in December, 1800."

Nucleus, urate of ammonia with oxalate of lime; it is surrounded by layers of oxalate of lime. The exterior consists of the phosphates.

Presented by Sir Wm. Blizard, 1811.

B i 29. Nucleus, urate of ammonia with oxalate of lime, around this oxalate of lime with a little urate of ammonia, next fusible calculus mixed with some urate of ammonia, and lastly, phosphate of lime in the form of radiating crystalline fibres, having layers of phosphate with a little carbonate of lime, which are not crystalline.

Presented by John Gunning, Esq., 1816.

B i 30. A section of a small calculus consisting of urate of ammonia, surrounded by oxalate of lime, and coated by the phosphates.

B i 31. A transverse section of a calculus consisting of urate of ammonia, sur-

rounded by oxalate of lime, and coated by the mixed phosphates containing carbonate of lime. *Presented by W. T. Brande, Esq.*, 1842.

B i 32. A calculus which made its way into the vagina through an ulcerated opening in the bladder. It was removed by slightly dilating the opening with a bistoury.

It is composed of a small nucleus of impure urate of ammonia, surrounded first by oxalate of lime, and lastly by the earthy phosphates.

Presented by Dr. U. Cumin, 1842.

B k. *Calculi consisting of four or more deposits, having a nucleus of Urate of Ammonia.*

B k 1. A large kidney-shaped calculus: delineated and described Plate VIII. fig. 11. *British Museum.*

B k 2. Nucleus, urate of ammonia with oxalate of lime, surrounded by layers of nearly pure oxalate of lime; upon these is deposited uric acid: the exterior consists of urate of ammonia and the mixed phosphates.

British Museum, 1809.

B k 3. "A vesical calculus extracted from a boy five years of age, at St. George's Hospital, by Mr. Home, 1809."

Nucleus, urate of ammonia surrounded by a thin layer of oxalate of lime; remainder uric acid coated by the fusible calculus.

Presented by Everard Home, Esq., 1809.

B k 4. "From a boy eight years of age, at St. George's Hospital."

Nucleus, urate of ammonia mixed with variable proportions of oxalate of lime, and surrounded by uric acid, upon which is deposited oxalate of lime mixed with uric acid, and the whole is coated by the fusible calculus. *Hunterian.*

B k 5. A section of a small calculus.

The central portion of which consists of urate of ammonia, mixed with oxalate of lime; upon this is deposited oxalate of lime; then uric acid thinly coated by the mixed phosphates containing urate of ammonia. *Presented by John Gunning, Esq.*, 1816.

B k 6. A section of a calculus, the nucleus consists of urate of ammonia with uric acid; upon this is deposited oxalate of lime: the exterior consists of uric acid mixed with urate of ammonia, a large quantity of oxalate of lime, and some phosphate of lime. *Hunterian.*

B k 7. Nucleus, urate of ammonia with oxalate of lime, surrounded by oxalate of lime; upon this is deposited uric acid with oxalate of lime; the whole is capped by the fusible calculus. *British Museum,* 1809.

B k 8. Nucleus, urate of ammonia with oxalate of lime, the proportion of the latter increases as it approaches the exterior; upon this are deposited the mixed phosphates, containing carbonate of lime: the whole is coated by a thin layer of oxalate of lime, on which are transparent crystals of pure oxalate of lime. *Hunterian.*

B k 9. A small oval calculus, the nucleus of which consists of urate of ammonia with oxalate of lime; upon this is deposited, first, uric acid; secondly, the mixed phosphates; and lastly, a thin layer of urate of ammonia. *Presented by Sir Wm. Blizard,* 1819.

B k 10. A nearly spherical calculus, having a tubercular exterior.

Nucleus, urate of ammonia with oxalate of lime; upon this is deposited a mixture of oxalate and phosphate of lime, then pure oxalate of lime, and this is coated in parts by uric acid. (Vide Plate VI. figs. 6, 7.) *Presented by Sir Wm. Blizard,* 1819.

B k 11. Nucleus, urate of ammonia with oxalate of lime; around this is deposited uric acid containing oxalate of lime, then oxalate of lime with urate of ammonia, and lastly, the mixed phosphates with carbonate of lime. *Presented by Thomas Keate, Esq.*, 1810.

B k 12. Nucleus, urate of ammonia with oxalate of lime, around which is deposited impure uric acid, upon this latter urate of ammonia with the

mixed phosphates, and it is capped by the fusible calculus. (Vide Plate VIII. fig. 12.) *Presented by Sir Wm. Blizard.*

B k 13. Four large irregularly-shaped calculi, and nine small spherical calculi, which were removed from the Preparation No. 949 in the printed Catalogue of Pathological Specimens in Spirit. The preparation, together with the calculi and a drawing of the parts while in a recent state, were presented to Mr. Hunter by Mr. Young, 1792. (Delineated and described Plate VIII. figs. 1, 2, 3, 4.) *Hunterian.*

SERIES III.

CALCULI OF WHICH THE NUCLEUS OR PRIMARY DEPOSIT CONSISTS OF OXALATE OF LIME.

The oxalate of lime calculus is usually of a rounded figure, and of a dark brown or almost black colour; its surface is rough and tuberculated; when divided it generally presents an imperfectly laminated structure, the concentric layers forming irregular undulating lines; its texture is usually very hard, and its internal appearance has been not inaptly compared to the knotted structure of heart of oak. (Vide Plate IX. figs. 1, 2, 3.)

The composition of this calculus was first accurately determined by Dr. Wollaston, although it had been previously long known as a distinct species, and, from a fancied resemblance to the fruit of the mulberry, had been termed the *mulberry* calculus.

Of the oxalate of lime calculus there are, however, two other varieties which require individual notice. One of these exhibits a crystalline structure through-

out. Its external surface is studded over with brilliant octohedral crystals, which often present very acute angles; these calculi are usually of a white colour, and consist of nearly pure oxalate of lime. (Vide Plate IX. figs. 4, 5.)

The other variety of the oxalate of lime concretion occurs in the form of small rounded masses, whose surface is neither crystalline nor tubercular, but perfectly smooth and polished, and which, from a certain resemblance in their colour, size and general appearance, have been termed *hemp-seed* calculi. The smoothness of the exterior of these calculi has been attributed to the attrition which they undergo against one another, and this explanation is sufficiently probable, as they usually occur in great numbers. They consist, according to Dr. Wollaston *, of oxalate and phosphate of lime.

The internal structure of the hemp-seed calculus varies in different specimens; sometimes, though rarely, it is crystalline at the centre, and laminated towards the exterior like the pisiform uric acid concretion. Most commonly its structure is so finely laminated as to be almost compact, resembling that of the urate of ammonia calculus.

Of the concretions having the crystalline centre, there is in the Museum a very remarkable collection, consisting of several thousands that were taken from the kidney of a lad, which from obliteration of the ureter had become dilated into an enormous cyst. The calculi vary in size from a small pin's head to about an eighth of an inch in diameter. They do not decrepitate before the blow-pipe, and are composed of pure oxalate of lime. (Vide C 29 and Plate VIII. fig. 6.)

To those concretions having the structure of the urate of ammonia calculus, the term of *hemp-seed* calculi appears to have been originally applied. These calculi are of a light grey or ash colour, their surface is very highly polished, and frequently presents flattened faces; they always contain more or less urate of ammonia, the presence of which is shown by their decrepitating violently when heated. The relative proportion of oxalate of lime and urate of ammonia in these concretions is exceedingly various, so that it is sometimes difficult to determine to which species the calculus belongs. In general, the nucleus contains a larger proportion of urate of ammonia, while oxalate of lime predomi-

* Phil. Trans., 1797, p. 224.

nates at the exterior. In some specimens, however, the quantity of urate of ammonia is very small. (Vide specimen, C 30.) These calculi very frequently form the nucleus of a mulberry concretion.

Crystals of oxalate of lime are often to be observed on the surface of the mulberry calculus, and also of other concretions, and may be mistaken for those of the triple phosphate; they may however be distinguished in general by their superior brilliancy and by their edges not becoming opake on exposure to the air: chemical examination of course removes all doubt as to their nature. Dr. Wollaston describes the crystal of oxalate of lime as assuming the form of a flattened octohedron*.

Oxalate of lime is a very frequent constituent of urinary concretions: in this Collection, the relative number of all the calculi originating with a decided ... less than one in every seven, or as 1 : 7¼; and it

The formation of a
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frequency with which
specimens included in
n; and it will then be
orms a prominent con-
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calculus be divided, the
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calculus arises from a ten-
ll masses radiating from a

und only among calculi and within
however, described by Mr. H. J.
d production, having the form of

es found in the intestinal canal of
a mass of vegetable fibre. Their
ed they present the appearance of
he calculus.

centre, and that a *mulberry* calculus may therefore be regarded as made up of a number of small crystalline globules similar in structure to those figured in Plate VIII. fig. 6. The section of the calculus, figured in Plate IX. fig. 6, adds weight to this conjecture.

The dark colour of the mulberry calculus is supposed by Drs. Wollaston and Marcet to depend upon the admixture of blood, which they conceive to be derived from the mucous membrane of the urinary passages lacerated by the rugged exterior of the calculus. Although this may be partly its source, yet Dr. Prout has correctly observed, that "large crystallized concretions of the oxalate of lime, presenting sharp angular points in all directions, have been voided, during the formation or even the passage of which no hæmorrhage had been observed*." He has also remarked that the oxalic acid diathesis is peculiarly liable to be attended by hæmorrhage from the kidney, even where there is no mechanical cause to excite it. In confirmation of this opinion it may be observed, that in some instances effused blood has coagulated in the bladder and formed a nucleus, upon which oxalate of lime has subsequently concreted. (Vide Plate IX. fig. 8.) The animal matter afterwards shrinks as the calculus dries, and thus gives rise to the formation of a hollow calculus.

Oxalate of lime is very rarely met with in the state of gravel; it appears, however, to be nôt uncommonly deposited from the urine in the form of minute octohedral crystals, which are usually mixed with a considerable quantity of uric acid and urate of ammonia†. According to Dr. Donné, this deposit is always produced in the urine whenever any soluble oxalate is contained in the food, as in the various species of sorrel (*Rumex Acetosa* and *Oxalis Acetosella*), and in *Rheum Rhaponticum* and *R. palmatum*, the leaf-stalks of which are employed in making tarts and puddings‡. There can be, however, little doubt but that its origin cannot always be referred to these extraneous sources, but is the result of some derangement of the assimilative processes.

Oxalate of lime concretions are seldom very pure; they commonly contain variable quantities of urate of ammonia, uric acid, urate and carbonate of lime,

* Prout on Stomach and Urinary Diseases, 3rd edit. p. 328. By others, as Rapp and Brugnatelli, the colour is supposed to depend upon a peculiar colouring matter.—Martin: *De Lithogenesi Com. Med.*, p. 41.

† G. Bird, Guy's Hospital Reports, no. xiv.

‡ *Journal de Chémie Médicale*, tome v.

with colouring and animal matter. Dr. Henry, from 10 grains of a well-marked specimen, obtained by analysis 6·6 oxalate of lime, 1 grain uric acid, 0·3 phosphate of lime, and a quantity of dark-coloured flocculi of animal matter*.

The frequency with which oxalate of lime is preceded by the deposition of urate of ammonia has been already alluded to; and the nucleus even of the purer varieties of this concretion almost always contains more or less uric acid, which gives it a lighter colour and more regular lamellar structure than the rest of the calculus.

This species of calculus may be distinguished from every other by its increasing considerably in volume, or vegetating, as it is technically termed, when exposed to the flame of the blow-pipe; a bulky white ash is left, consisting of pure lime, which, when moistened with water, gives out heat, and renders turmeric paper brown. If the calculus be merely charred, it is converted into carbonate of lime, which may be recognized by the residual ash effervescing violently on the addition of an acid.

The oxalate of lime calculus is insoluble in acetic acid. It readily dissolves in nitric and muriatic acids if they are not too much diluted, and from the solutions oxalate of lime is precipitated on the addition of ammonia. Sulphuric acid converts its lime into sulphate of lime, and sets free the oxalic acid. A solution of pure caustic potass has little action upon this calculus, but if digested for some time in a boiling solution of carbonate of potass, carbonate of lime is formed, and oxalate of potass remains in solution: from this solution the oxalic acid of the calculus may be obtained in a pure state, by the addition of acetate of lead; oxalate of lead mixed with some carbonate of lead thereupon precipitates, which after being collected on a filter and washed with distilled water, is to be decomposed by diffusing it in water, and passing a current of sulphuretted hydrogen through the mixture; sulphuret of lead is formed and precipitates, and the clear liquid by careful evaporation affords regular crystals of oxalic acid.

Oxalate of lime is distinguished from phosphate of lime, or the triple phosphate, by its insolubility in acetic acid and dilute muriatic acid, as well as by the effect of heat. A mixture of oxalate and phosphate of lime may be readily separated by dissolving it in muriatic acid and precipitating both the salts by

* Annals of Philosophy, vol. xv. p. 114.

the addition of ammonia; on digesting the moist precipitate in acetic acid, phosphate of lime alone is dissolved. It is of course a simpler process to digest the powdered calculus at once in acetic acid; but it requires a long digestion to take up the whole of the phosphate of lime. A ready method of determining whether the earthy phosphates are present in a mulberry concretion, is to char the calculus and dissolve the residue in strong acetic acid; if caustic ammonia causes a precipitate in the clear solution, the presence of one or both of these salts is indicated.

From urate of lime it may be separated by the action of acetic acid, which dissolves the lime of the urate of lime, leaving the uric acid and oxalate of lime undissolved; or the mixture of oxalate and urate of lime may be digested in muriatic acid, by which only the uric acid of the urate of lime is left undissolved. On the addition of ammonia to the solution, oxalate of lime precipitates; while the lime which was in combination with uric acid may be afterwards thrown down by the addition of oxalate or carbonate of ammonia. Urate of lime is also sparingly soluble in boiling water, while the oxalate is absolutely insoluble; in this manner it may also be separated from urate of ammonia.

The chemical properties of oxalate of lime are so distinct from those of all other substances likely to be met with in the examination of calculi, that no difficulty can occur in effecting their separation.

C. *Oxalate of Lime.*

C 1. A spherical calculus consisting throughout of crystallized oxalate of lime; its external surface is closely studded with brilliant octohedral crystals. (Vide Plate IX. figs. 4, 5.) *Presented by Everard Home, Esq.*, 1807.

C 2. An oxalate of lime calculus.

"From a boy at St. George's, by Mr. Hawkins."

The central portion of this specimen is semi-crystalline and of a dark colour: the exterior is white, and covered with minute crystals of oxalate of lime. *Hunterian.*

C 3. A section of a calculus composed of compact white oxalate of lime, mixed with a little urate of ammonia, and at the exterior with carbonate of lime. The internal structure of this calculus is similar to that figured in Plate IX. fig. 6. *Hunterian.*

C 4. A section of the ordinary oxalate of lime calculus, of an unusually large size. *British Museum*, 1809.

C 5. A small oblong tuberculated calculus, not divided, in order to show its similarity in form to the fruit of the mulberry. "From a boy at St. George's Hospital." (Vide Plate IX. fig. 3.) *Hunterian.*

C 6. A large mulberry calculus. "From Dr. Groenvelt by Mr. Mason."—*Sloanian MS. Catalogue.*

Oxalate of lime; the nucleus contains a small proportion of urate of ammonia. *British Museum*, 1809.

C 7. A large and characteristic specimen of the mulberry calculus, having the following curious manuscript memorandum by Sir Hans Sloane:—

"This stone was given me by Mr. Pearce, who assisted while it was cut out of the bladder of a sailor, 29 years of age, in St. Bartholomew's Hospital in the year 1717, by Mr. Salter. He was a lusty, strong, hardy fellow. The pain in his bladder was not great till two days before he was cut, but during these it was very acute, and probably the tubercles at the surface were formed during this time; indeed the whole seems not to have been long in formation. There is a nucleus or central body, about which the incrustations were successively formed; they are irregular, and as it were curled or undulated. The urine seems to have been in ebullition when the whole, and especially when the tubercles, were formed. None but a fellow so hardy could have borne such principles in him, abid the formation of such a stone, or indured the cutting of it out, all which yet he bore well, recovered, and went away in good health to sea."—*Sloanian MS. Catalogue.*

Oxalate of lime upon a small nucleus of oxalate of lime mixed with urate of ammonia. (Vide Plate IX. figs. 1, 2.) *British Museum*, 1809.

C 8. A small mulberry calculus, the external surface of which is semi-crystalline. *Presented by J. G. Andrews, Esq.*, 1841.

C 9. Two renal calculi.

Oxalate of lime, mixed at their centres with urate of ammonia.

Hunterian.

C 10. Two portions of an oxalate of lime calculus. *Hunterian.*

C 11. A small spherical urinary calculus extracted by the high operation by Sir Everard Home, Bart.

Nearly white oxalate of lime with crystals of the same on its surface.

Presented by Sir E. Home, Bart., 1827.

C 12. A minute oval calculus, consisting of oxalate of lime.

Presented by Mr. Long's Executors, 1818.

C 13. "Calculus grit taken from the bladder of a boy at St. George's Hospital in 1806. It had been concreted into one mass, but broke down on being compressed by the forceps. The boy recovered."

Loosely cohering oxalate of lime mixed with a little uric acid.

Presented by Everard Home, Esq., 1807.

C 14. A calculus consisting of very compact oxalate of lime.

Presented by Wm. Lynn, Esq., 1827.

C 15. A compact oxalate of lime or mulberry calculus, presented by James Briggs, Esq., with the following history:—

"Extracted from the bladder of a man aged 24, by trade a printer, at a second operation, affording one among others of the success of the method termed by the French 'Taille en deux tems.' In attempting to extract the stone during the first operation, it slipped from the forceps; and though it could be felt, it could not afterwards be laid hold of, in consequence of being apparently lodged in a pouch of the bladder. The operation was completed eight days afterwards, the stone being found in contact with the opening made into the bladder. It was necessary to enlarge the wound slightly, and its extraction was difficult; yet no ill consequence followed, either in the interval between the two operations or afterwards, and the recovery was more rapid than usual."

Oxalate of lime upon a nucleus of oxalate of lime containing a little urate of ammonia.

C 16. An oval-shaped calculus composed of nearly pure oxalate of lime; the nucleus contains a little uric acid. Its outer layers are striated in a direction perpendicular to the surface, as if from an assemblage of crystalline fibres. *Hunterian.*

C 17. Some very minute calculi, "from Mr. Jones's bladder."

The small dark-coloured calculi resembling rape-seed consist of pure oxalate of lime; the irregular shaped one consists of phosphate of lime, having a small oxalate of lime calculus within it; the other of phosphate of lime with apparently a nucleus of uric acid. *Hunterian.*

C 18. A small renal calculus of oxalate of lime.

Presented by Wm. Lynn, Esq., 1827.

C 19. A section of a very beautiful renal calculus, consisting of nearly white oxalate of lime, coated in parts by the mixed phosphates. (Vide Plate IX. fig. 6.) *Hunterian.*

C 20. A small oblong calculus, "from a boy nine years old, 1788."

Oxalate of lime; the exterior white coat contains a trace of phosphate of lime. *Presented by Sir Wm. Blizard*, 1819.

C 21. Three small irregular concretions composed principally of oxalate of lime.

Presented by Sir Wm. Blizard.

C 22. Section of an oxalate of lime calculus, the nucleus containing some uric acid. *Presented by W. T. Brande, Esq.*, 1842.

C 23. Several small calculi which were passed by the urethra of "a boy rather more than seven years of age, of a delicate habit of body, fair complexion and lymphatic temperament; subject occasionally to slight attacks of gastric fever and acidity of stomach, and has within these three years been troubled with the gravel."

Oxalate of lime containing a little carbonate of lime.

Presented by W. T. Brande, Esq., 1842.

C 24. A small oval mulberry calculus.

Presented by W. T. Brande, Esq., 1842.

C 25. A large round mulberry calculus, having a small nucleus which contains a little urate of ammonia. *British Museum.*

C 26. A section of "a large, rough, round human stone: calculus spinosus Celsi."—*Sloanian MS. Catalogue.*

Oxalate of lime; the nucleus contains a small quantity of urate of ammonia.

C 27. Composition similar to the preceding. *Hunterian.*

C 28. Oxalate of lime; the nucleus contains a little urate of ammonia. *British Museum*, 1809.

C 29. Numerous small round calculi consisting of nearly pure oxalate of lime. The surface of all these calculi is perfectly smooth and polished, and of a light brown colour: their structure is crystalline at the centre and laminated towards the exterior; none of them exceed an eighth of an inch in diameter, and they altogether weighed three ounces avoirdupois. A few of them are delineated in Plate VIII. fig. 6.

These calculi were taken from the pelvis and infundibula of a kidney, which from obliteration of the ureter had become dilated into an enormous cyst. The Preparation is in the Museum, and the following particulars of the case were communicated by Mr. Langstaff:—

The patient, a young man aged 19, had enjoyed tolerable health until the last three years of his life, when he was attacked with symptoms indicating disease of the kidneys. These symptoms became gradually more apparent, his urine was passed with great difficulty, although there was no disease of the urethra, nor had he ever had gonorrhœa. His urine was turbid, sometimes mixed with a gritty sediment, and occasionally with blood. About twelve months prior to his death his health declined, and an enlargement could be felt in the left hypochondrium. He experienced violent pain in the loins. His urine was loaded with mucus and sometimes mixed with blood, the hœmaturia being at one time alarmingly profuse. The enlargement in the hypochondrium increased, and was painful on pressure; fever supervened, and he gradually sunk.

On opening the abdomen the left kidney was observed forming a large tumour, which occupied more than half of the cavity of the abdomen. It

extended obliquely from the iliac fossa to the diaphragm, displacing by its size most of the viscera in the right hypochondrium. It resembled in figure the lobulated appearance of the fœtal kidney, and its membranous capsule was slightly thickened. On cutting it open, the calculi, together with five pints of fluid, escaped, which smelt like putrid pus and urine. Scarcely any of the glandular structure of the kidney remained, the infundibula were formed into large sacs, and the commencement of the ureter was completely obliterated by a deposit, apparently of lymph. The right kidney was healthy. There were no morbid signs in the bladder, except a greater degree of vascularity of its mucous coat than natural. The thoracic and abdominal viscera were perfectly healthy.

Mus. Langstaff, 1841.

C 30. A small hemp-seed calculus of a triangular figure; its surface is highly polished, and is of a dark grey colour.

Oxalate of lime mixed with a little urate of ammonia: this calculus decrepitates violently before the flame of the blowpipe. *Hunterian.*

C 31. A section of a calculus, the general figure of which bears some resemblance to a water-bottle, being contracted like an hour-glass in the middle. It consists of nearly pure oxalate of lime, and its external surface is covered in every part with octohedral crystals.

It is not very rare to meet with calculi of this peculiar form. It has been conjectured that in such cases they have been partly lodged in the orifice of the ureter, or in a pouch of the bladder, and that the growth of the calculus has continued unobstructed at the two extremities, while it has been prevented in the middle by the constriction of the orifice. But the deposition of crystals even on the constricted portion seems scarcely consistent with this explanation, unless it is conceived that they were deposited after the calculus had escaped into the cavity of the bladder. (Vide Plate XII. fig. 12.) *Presented by G. J. Guthrie, Esq.*, 1842.

C 32. A small oxalate of lime calculus, voided by the urethra of a man. It is of a flattened triangular figure. *Presented by Dr. U. Cumin*, 1842.

C 33. A mulberry calculus remarkable for the extreme irregularity of its external surface. This calculus was taken by Mr. Guthrie from the bladder

of a young man aged nineteen, who had suffered from symptoms of stone all his life, and when a child had been sounded several times. The greatest difficulty was experienced in withdrawing the stone by the ordinary forceps, in consequence of the projecting points of the calculus becoming entangled in the folds of the contracted bladder. This difficulty was surmounted by using a pair of very large forceps, the blades of which were sufficiently capacious to include every part of the calculus. The patient was bled the same night to sixteen ounces, and had not afterwards a bad symptom. He died ten years after of diseased liver. (Vide Plate XII. fig. 13.)

Presented by G. J. Guthrie, Esq., 1842.

C a. *Oxalate of Lime. Uric Acid.*

The transition from the oxalate of lime to the uric acid diathesis is always very abrupt and well-defined, and in general the deposit of oxalate of lime is inconsiderable when compared to that of uric acid.

C a 1. A large calculus consisting of nearly pure and compact uric acid upon a small nucleus of oxalate of lime, together with a smaller calculus consisting entirely of uric acid. These calculi were taken from Hannah Piermont of Warnford, October 1805.

The small calculus has a smooth articulating surface, but there is no corresponding surface on the larger calculus.

Presented by Mr. Long's Executors, 1818.

C a 2. Seven somewhat flattened calculi.

Compact light-coloured uric acid upon a small nucleus of oxalate of lime. *Hunterian.*

C a 3. A large oval calculus, consisting of compact uric acid upon a small nucleus of oxalate of lime. *Presented by J. G. Andrews, Esq.*, 1841.

C a 4. A section of a nearly circular flattened calculus.

Oxalate of lime surrounded by impure uric acid.

Presented by John Gunning, Esq., 1816.

C a 5. Two triangular calculi, taken apparently from the same bladder. "From Dr. Groenvelt by Mr. Mason."—*Sloanian MS. Catalogue.*

Compact laminated uric acid surrounding a nucleus of light-coloured oxalate of lime containing some uric acid. A zone of a bright flesh-red colour immediately surrounds the nucleus. The surface of these calculi is earthy and friable, and has a shade of pink; they appear to have been subjected to the action of the urine for a considerable time after the deposit of uric acid had ceased to take place. *British Museum.*

C a 6. A large oval calculus, consisting of imperfectly laminated uric acid upon a nucleus of oxalate of lime.

C a 7. A nearly round calculus, consisting of uric acid deposited upon a hollow crust or shell of impure oxalate of lime. This crust was most probably formed upon a clot of blood, which has afterwards shrunk; it is mixed with uric acid and urate of ammonia, and is interspersed with colourless crystals of oxalate of lime. The outer uric acid layers contain some oxalate of lime, and the external surface is partially coated by the phosphates. (Vide Plate IX. fig. 8.) *British Museum*, 1809.

C a 8. An oval calculus, somewhat broken.

Uric acid upon a nucleus of oxalate of lime.

Presented by Sir Wm. Blizard, 1819.

C a 9. An oval calculus, and another of a rude triangular figure, having on one of its sides a smooth concavity produced by contact with the other stone. Both consist of compact uric acid deposited upon a small dark-coloured nucleus of oxalate of lime.

Presented by Benj. Cooper, Esq., 1829.

C a 10. A section of a large calculus.

Oxalate of lime surrounded by uric acid. *Hunterian.*

C a 11. "An oval flat urinary calculus, removed by operation from Mr. Squire, 1819."

Nucleus, oxalate of lime, on which animal matter has been deposited; the remainder compact uric acid.

Presented by Sir Wm. Blizard, 1819.

C a 12. A section of a small oval calculus.

Uric acid upon a nucleus of oxalate of lime.

Presented by John Gunning, Esq., 1816.

C a 13. Impure uric acid deposited upon a small excentric nucleus of oxalate of lime. *British Museum,* 1809.

C a 14. A small oval calculus.

Oxalate of lime surrounded by imperfectly laminated uric acid; the nucleus contains some uric acid mixed with the oxalate of lime.

Presented by Sir Wm. Blizard, 1821.

C a 15. An oval uric acid calculus, the nucleus of which appears to have been a small clot of blood, which has been surrounded by oxalate of lime mixed with some urate of ammonia.

Presented by Sir Wm. Blizard, 1819.

C a 16. A well-marked mulberry calculus surrounded by a narrow layer of uric acid mixed with a little oxalate of lime; the nucleus contains some urate of ammonia. (Vide Plate IX. fig. 10.) *Hunterian.*

C a 17. A portion of a calculus.

Uric acid upon oxalate of lime.

Presented by Sir Wm. Blizard, 1819.

C a 18. A large flat calculus, consisting of oxalate of lime surrounded by uric acid. The nucleus contains some uric acid, and the exterior is slightly coated in parts by the fusible calculus. *British Museum.*

C a 19. A longitudinal section of a calculus, the nucleus of which consists of oxalate of lime mixed with uric acid; it is surrounded by pure uric acid. *Hunterian.*

C a 20. Non-laminated uric acid, having a porous and earthy texture deposited upon a small oxalate of lime calculus. *Hunterian.*

C a 21. A small oxalate of lime calculus coated by semi-crystalline grains of uric acid. This specimen was voided by the urethra of a gentleman about forty-five years of age, who passed, a short time after, crystals of pure uric acid. *Presented by Thomas Taylor, Esq.*, 1842.

C b. *Oxalate of Lime. Urate of Ammonia.*

Of this variety of calculus the Museum possesses no specimen.

C c. *Oxalate of Lime. Earthy Phosphates.*

It has been observed by Dr. Prout, that one of the first changes occurring in the transition from the oxalate of lime to the phosphatic diathesis is the secretion of an excess of lime, probably in the state of carbonate, and that as the quantity of lime becomes greater, the proportion of the oxalic acid is decreased, while that of the phosphoric acid is increased, until at length phosphate of lime in nearly a pure state is deposited. The accuracy of this observation is probably confirmed by the circumstance that the exterior crust of the following calculi generally contains a larger proportion of phosphate of lime than is met with when the fusible calculus surrounds a nucleus of any other substance: the proportion of carbonate of lime mixed with the phosphates is also greater: moreover, phosphate of lime, in a pure state, appears to be deposited most frequently upon nuclei of oxalate of lime.

C c 1. A calculus from the human bladder.

Oxalate of lime, coated by crystallized phosphate of lime disposed in the form of radiating fibres. (Vide Plate IX. fig. 9.)

Presented by Wm. Lynn, Esq., 1827.

C c 2. A small oval calculus.

Oxalate of lime, coated by phosphate of lime disposed in the form of radiating crystalline fibres.

The phosphate of lime in this and the preceding specimen fuses before the blowpipe, but does not contain any appreciable quantity of the triple phosphate. *Presented by Sir Wm. Blizard,* 1821.

C c 3. Oxalate of lime with a little uric acid, surrounded by compact earthy-looking phosphate of lime. *British Museum,* 1809.

C c 4. A section of a calculus.

Oxalate of lime coated by the mixed phosphates, with a little carbonate of lime. *Presented by John Gunning, Esq.,* 1816.

C c 5. A small flat oval calculus, consisting of oxalate of lime with urate of ammonia; it is coated by the mixed phosphates.

Presented by Sir Anthony Carlisle, 1821.

C c 6. An oblong calculus with an articulating surface at one of its extremities; in the same tray there is a smaller calculus, with likewise an articulating surface, but which does not appear to have belonged to the other.

Oxalate of lime coated by the mixed phosphates containing carbonate of lime. *Hunterian.*

C c 7. An oval calculus, the nucleus of which is composed of oxalate of lime mixed with uric acid; the remainder consists of the phosphates and carbonate of lime mixed in various proportions.

Presented by Wm. Lynn, Esq., 1827.

C c 8. Two renal calculi.

Oxalate of lime partially coated and capped by the mixed phosphates; the centre contains some urate of ammonia. *Hunterian.*

C c 9. A calculus from the human bladder.

Oxalate of lime coated by the fusible calculus.

Presented by Wm. Lynn, Esq., 1827.

C c 10. A human mulberry calculus, "from Dr. Groenvelt by Mr. Mason."—*Sloanian MS. Catalogue.*

The central portion of this calculus consists of oxalate of lime with uric acid; the remainder of oxalate of lime and the mixed phosphates in alternate layers. *British Museum*, 1809.

C c 11. Oxalate of lime coated by the mixed phosphates.
Presented by Wm. Lynn, Esq., 1827.

C c 12. An oblong calculus, composed of oxalate of lime coated by the fusible calculus; its centre is mixed with a little urate of ammonia.
Presented by Sir Anthony Carlisle, 1821.

C c 13. An oblong calculus.
The nucleus consists of an irregular deposit of oxalate of lime and uric acid; the exterior of the mixed phosphates with a little carbonate of lime. *Hunterian.*

C c 14. A calculus "taken from the bladder of Mr. Jonathan Garner, 1790." Nucleus, oxalate of lime with some uric acid; remainder, the phosphates containing layers of urate of ammonia. *Hunterian.*

C c 15. Half a calculus, having a small process.
White crystalline oxalate of lime surrounded by the earthy phosphates, containing a little carbonate of lime.
Presented by Sir Wm. Blizard, 1819.

C c 16. Two portions of a broken oblong calculus.
Mixed phosphates upon a nucleus of oxalate of lime.
Presented by Sir Wm. Blizard, 1819.

C c 17. A section of an oxalate of lime calculus. It is surrounded by the phosphates, which form a large mass on one of its extremities.
Presented by John Gunning, Esq., 1816.

C c 18. Three portions of a renal calculus.
Oxalate and phosphate of lime in irregularly alternating layers.
Hunterian.

C c 19. A portion of a large calculus, consisting of the mixed phosphates incrusting an impure oxalate of lime calculus. *Hunterian.*

C c 20. Oxalate of lime coated by the fusible calculus; on one part of its exterior is a deposit of the crystallized triple phosphate. *Hunterian.*

C c 21. A large mulberry calculus, surrounded by a narrow layer of oxalate and carbonate of lime; the nucleus contains some uric acid.

"From Dr. Groenvelt by Mr. Mason."—*Sloanian MS. Catalogue.*

British Museum, 1809.

C c 22. An oblong calculus, contracted at one part so as to divide it into two unequal portions. "From Mr. Paul by Mr. Ranby."—*Sloanian MS. Catalogue.*

Oxalate of lime coated by the mixed phosphates: the nucleus contains a little urate of ammonia. *British Museum,* 1809.

C c 23. A portion of a large calculus consisting of the mixed phosphates upon a nucleus of oxalate of lime. *Hunterian.*

C c 24. A small broken calculus.

Oxalate of lime with urate of ammonia, coated by phosphate of lime mixed with phosphate of magnesia and ammonia and carbonate of lime. *Presented by John Gunning, Esq.,* 1816.

C c 25. Oxalate of lime coated by the mixed phosphates.

Presented by Thomas Keate, Esq., 1811.

C c 26. A small but singularly mammillated calculus.

Oxalate of lime coated by phosphate of lime.

British Museum, 1809.

C c 27. A section of a large calculus, consisting of the mixed phosphates surrounding an oblong nucleus of oxalate of lime. On one extremity of the calculus, a large mass of crystallized triple phosphate has been deposited. *Mus. Taunton,* 1841.

C c 28. A section of an oxalate of lime calculus, coated by the phosphates. The nucleus contains some urate of ammonia.

Presented by Thomas Keate, Esq., 1811.

C d. *Oxalate of Lime. Uric Acid. Urate of Ammonia.*

Of this variety of calculus the Museum possesses no specimen.

C e. *Oxalate of Lime. Uric Acid. Oxalate of Lime.*

C e 1. An oval calculus, the nucleus of which consists of oxalate of lime mixed with a little urate of ammonia; upon this has been deposited uric acid, and the whole is coated by crystallized oxalate of lime. The lighter-coloured portion of the uric acid deposit contains some oxalate of lime. "From Dr. Groenvelt by Mr. Mason."—*Sloanian MS. Catalogue.* *British Museum.*

C f. *Oxalate of Lime. Uric Acid. Earthy Phosphates.*

C f 1. An oval calculus, having an oblong nucleus of oxalate of lime, surrounded first, by compact laminated uric acid; and lastly, by the mixed phosphates. *Presented by Sir Wm. Blizard*, 1819.

C f 2. Impure dark coloured oxalate of lime, surrounded first, by uric acid with a little oxalate of lime; and lastly, by phosphate of lime with some phosphate of magnesia and ammonia.
Presented by Mr. Long's Executors, 1818.

C f 3. A large oblong calculus, consisting of uric acid coated by a narrow layer of phosphate of lime and deposited upon a small mulberry nucleus. The uric acid immediately around the nucleus is in the form of radi-

ating crystalline granules, while the outer portion is compact and laminated. *Hunterian.*

C f 4. Nucleus, oxalate of lime with urate of ammonia; upon this is deposited uric acid, and the whole is surrounded by the fusible calculus. The thin grey layer between the uric acid and the phosphates consists of urate of ammonia mixed with oxalate of lime. "From Dr. Groenvelt by Mr. Mason."—*Sloanian MS. Catalogue.*

British Museum, 1809.

C f 5. A broken calculus.

Central portion, oxalate of lime with phosphate of lime, a layer of impure uric acid surrounds this, and the whole is coated by the phosphates containing some carbonate of lime. *Hunterian.*

C f 6. A small urinary calculus "extracted from John Barton, aged 6 years."

Oxalate of lime with urate of ammonia, surrounded by uric acid mixed with oxalate of lime, and coated by the mixed phosphates.

Presented by the Executors of the late Mr. Long, 1818.

C f 7. Impure uric acid deposited upon a small oval nucleus of oxalate of lime, and coated by the phosphates containing urate of ammonia with some oxalate of lime. *Hunterian.*

C f 8. A large oblong calculus, removed by operation from the bladder of Mr. M., æt. 59: operation performed by Mr. Liston. The patient recovered.

Compact laminated uric acid deposited upon a small nucleus of impure oxalate of lime, and coated by a thin layer of the mixed phosphates.

This calculus is of remarkable interest as illustrative of the fact, that calculi occasionally undergo partial solution while in the bladder. The appearances which lead to this conclusion are as follows. The external surface of the calculus is very rough and uneven, and in some places is eaten into small holes, which are excavated, or as it were undermined at their sides. Its section shows that the concentric layer of uric acid, of which the calculus is composed, are not continued

entirely around it, but terminate abruptly at those parts which correspond to the excavations on the surface, as if a portion of the calculus at these points had been either broken away or dissolved. Lastly, that these effects, however produced, must have taken place while the calculus was in the bladder, is shown by the layer of the earthy phosphates covering all its irregularities.

As in this case no attempt was made to crush or drill the stone, and as its texture is much too hard to allow of its having been broken by the ordinary operation of sounding, there is no reason to doubt that the calculus, previous to the deposition of the phosphates, had been partially dissolved, from the action of the urine, perhaps aided by the use of alkaline medicines. The exterior layer of the calculus consists principally of the phosphate of magnesia and ammonia, and is mixed with thin scales of urate of ammonia. (Vide Plate XII. figs. 16, 17.) *Mus. Liston.*

C g. *Oxalate of Lime. Urate of Ammonia. Uric Acid.*

C h. *Oxalate of Lime. Urate of Ammonia. Oxalate of Lime.*

C i. *Oxalate of Lime. Urate of Ammonia. Earthy Phosphates.*

Of the above varieties of calculi there are no specimens in the Museum; indeed, oxalate of lime appears to be very rarely followed by a deposit of urate of ammonia.

C k. *Calculi consisting of four or more Deposits, having a nucleus of Oxalate of Lime.*

C k 1. The nucleus of this calculus consists of granular oxalate of lime mixed at the centre with urate of ammonia; it is surrounded first, by a layer of the mixed phosphates; secondly, by a deposit of oxalate of lime; and lastly, by the fusible calculus mixed with urate of ammonia.

British Museum, 1809.

C k 2. The nucleus of this calculus consists principally of oxalate of lime mixed with carbonate of lime, uric acid, and urate of ammonia; around this is a much less compact layer of the same substances, but on the whole uric acid and urate of ammonia preponderate; and upon this is deposited phosphate and carbonate of lime, the whole being thinly coated by oxalate of lime. *Presented by Sir Wm. Blizard*, 1819.

C k 3. A small oblong calculus, consisting of four well-defined deposits in the following order: first, a small dark-coloured nucleus of oxalate of lime; secondly, uric acid; thirdly, a narrow layer of impure urate of ammonia; and lastly, the whole is surrounded by uric acid.

The outer layer of this calculus is tuberculated in a very singular manner, each tubercle being surrounded by a film of the earthy phosphate, so as to divide it into distinct lobes. Between the outer uric acid layer and the layer of urate of ammonia there is also a thin deposit of the earthy phosphates. *Hunterian.*

C k 4. The nucleus of this calculus consists of oxalate of lime; it is surrounded by uric acid, which towards the exterior of the calculus becomes exceedingly impure, being mixed with urate of ammonia, and urate and oxalate of lime. The outer layer is composed of finely tuberculated oxalate of lime, the tubercles of which are in parts coated by urate of ammonia. *Hunterian.*

SERIES IV.

CALCULI CONSISTING OF CYSTIC OXIDE, *Wollaston.* CYSTINE, *Berzelius.*

THE constituent of this species of calculus is a peculiar organic principle which has been hitherto only found as a product of the kidney; it is not, however, confined to the human species, having been discovered by Lassaigne as constituting a calculus taken from the bladder of a dog*.

Cystic oxide possesses the character of an organic base†. It readily dissolves in the mineral acids, with which it forms definite crystalline compounds; it is also easily soluble in solutions of caustic potass and soda. These solutions when left to spontaneous evaporation deposit small white granular crystals, which are soluble with difficulty in pure water, but readily dissolve when an excess of alkali is present‡. It is likewise soluble in a solution of ammonia; on evaporation the ammonia escapes, and the cystic oxide is obtained in a state of purity, having the form of transparent hexagonal prisms or thin plates.

From its alkaline solutions, cystic oxide is precipitated on the addition of acetic acid in the state of a fine white crystalline powder. It is so readily acted on by different agents, that its properties are best recognized by an enumeration of the substances whose action it is capable of resisting. These are water, alcohol, acetic acid, and solutions of tartaric and citric acids, and also of bicarbonate of ammonia§.

When heated the cystic oxide calculus is consumed, emitting at the same time a characteristic and highly disgusting odour: if a small fragment be carefully heated on platina foil, the metal immediately around it becomes coated with a blue iridescent pellicle, which disappears when the temperature is raised.

Urine containing cystic oxide in solution, is usually of a greenish-yellow colour, and has a peculiar and rather disagreeable odour. Its surface is generally covered by a thin oily-looking film, consisting of cystic oxide mixed with

* *Ann. de Chem. et de Physique*, tom. xxiii. 328.

† Liebig.

‡ Gmelin's *Handbuch der Chemie*, b. ii. p. 1020.

§ Wollaston, Phil. Trans., 1810, p. 224.

more or less of the phosphate of magnesia and ammonia*. When first passed it is either neutral or slightly acid, but on standing quickly becomes alkaline, and at the same time deposits a mixture of cystic oxide and the triple phosphate. In almost all the specimens of this urine that have been examined a deficiency of uric acid and of urea has been noticed.

Dr. G. Bird from 1000 parts of urine of the sp. gr. 1·0114, obtained by analysis 0·34 of cystic oxide†.

The presence of cystic oxide in the urine may readily be detected by the addition of acetic acid, which, while it retains the earthy phosphates in solution, causes the cystic oxide to be precipitated as a white crystalline powder.

The ultimate composition of this remarkable body, according to the calculated analysis of Thaulow, is as follows:—

Carbon	30·31 =	6 atoms.
Nitrogen	11·70 =	1 „
Hydrogen	4·94 =	6 „
Oxygen	26·47 =	4 „
Sulphur	26·58 =	2 „
	100·00‡	

The cystic oxide calculus was discovered by Dr. Wollaston in 1810. "In appearance these calculi resemble more nearly the triple phosphate of magnesia than any other calculus, but they are more compact than that compound is usually found to be: not consisting of distinct laminæ, but appearing as one mass confusedly crystallized throughout its substance. Hence, instead of having the opacity and whiteness observable in fusible calculi which consist of a number of small crystals concreted together, these calculi have a yellowish semi-transparency; and they have also a peculiar glistening lustre, like that of a body having a high refractive density."—*Wollaston.*

These calculi are extremely rare, and have seldom been observed of a very large size. The largest specimen probably that has been described is in the

* Prout on Stomach and Urinary Diseases; Willis on Urinary Diseases.

† Guy's Hospital Reports, No. III.

‡ *Ann. der Pharm.*, xxvii. 200 (1838).

Museum of University College, London. It weighed, when entire, above 850 grains. This calculus is also remarkable for its outer part not having the ordinary radiated and semi-crystalline structure, but consisting of concentric layers. It contained above 19 per cent. of sulphur*.

It has been remarked by Dr. Marcet, that cystic oxide calculi are remarkable for their purity, and from this circumstance he drew the general conclusion, that this diathesis "has a more exclusive tendency in regard to the formation of other kinds of calculi, than the other species of urinary concretions." The accuracy of this observation has been amply confirmed by Dr. Prout, although exceptions have been met with by Drs. Wollaston, Henry and Bird.

Another and a very important peculiarity of the cystic oxide diathesis is, that it appears to have an hereditary character; several individuals of the same family having been observed to be affected with this disease.

The chemical characters belonging to this calculus have been already enumerated; it is at once distinguished by its peculiar odour when burnt, and also by the very few menstrua which are incapable of dissolving it. From every other substance with which it may be mixed in the calculus it is most readily separated by a solution of ammonia.

The presence of sulphur is also characteristic of this substance; on which account the following process has been proposed by M. Liebig as an excellent method for detecting the presence of cystic oxide in calculi or gravel. The calculus is to be dissolved in a strong solution of potass, and to the solution is to be added so much of a solution of acetate of lead that all the oxide of lead may be retained in solution; when this mixture is boiled, the cystic oxide is decomposed, and a black precipitate of sulphuret of lead formed, which gives to the liquid the aspect of ink. Abundance of ammonia is also disengaged, and the alkaline fluid contains, among other products, oxalic acid†.

It has been remarked by Drs. Willis and Bird, that the cystic oxide calculus undergoes in the course of time a change of colour; such appears to have been the case with the specimens in Guy's Hospital Museum, which from a pale brown have become of a fine bluish-green colour‡.

* Dr. H. B. Jones, Medico-Chir. Trans., series 2. vol. v.
† Liebig's Animal Chemistry, by W. Gregory, M.D., p. 321.
‡ Guy's Hospital Reports, No. XIV.

D. *Cystic Oxide.*

D 1. A section of a large oval cystic oxide calculus, which measures one inch nine-tenths through its long axis, and one inch five-tenths and one inch one-tenth respectively, through its two short axes: when entire it weighed 740 grains. (Vide Plate IV. figs. 4, 5.) Ten grains on analysis gave,—

Cystic oxide	9·10
Phosphate of lime	0·38
Phosphate of magnesia and ammonia . . .	0·10
Animal matter and loss	0·42
	10·00

This specimen was taken after death from the bladder of Edmund Webster, aged twenty-one, a patient in St. Bartholomew's Hospital. He had come from Northampton, and was admitted into the Hospital in order to have the stone extracted. At the time of his admission he was found to be labouring under considerable fever with pain in the abdomen, especially in the hypogastric and also in the lumbar region. His urine was loaded with pus and mucus, and he had lost all power of retaining it. The calculus could be readily felt by the catheter, and also by the finger, when passed into the rectum. His symptoms continued the same until fifty-two hours before his death, when the secretion of urine was completely suppressed. He remained, however, perfectly sensible, and died while sitting in his chair, three weeks after his admission. The bladder was found after death to be much thickened and contracted; it was not larger than an ordinary sized orange, and in addition to the calculus, which lay immediately behind the prostate gland, it was filled with thin pus: its mucous membrane was also thickened, and the part on which the stone lay was ulcerated and partially covered with lymph. The ureters were distended to the size of the ileum, tortuous, and both they and the pelvis of each kidney were filled with a fluid similar to that

contained in the bladder. The pelvis and infundibula of both kidneys were dilated, and their cortical and tubular structure was studded throughout with numerous small abscesses containing pus.

The above particulars of the case were derived from notes taken by Dr. Jeafferson while acting as dresser under Mr. Vincent.

The other half of the calculus is in the Museum of St. Bartholomew's Hospital.

Presented by the Governors of St. Bartholomew's Hospital, 1841.

D 2. Several cystic oxide calculi, varying in size from a pin's head to that of a pea, which were voided at different times by a gentleman 40 years of age. "He had been subject from the age of six or seven years to pain in the region of the loins, not confined to any particular spot, and seldom of any acuteness, or such as to prevent his ordinary occupations, which obliged him to lead rather a sedentary life; his usual state of health was good, his habits very regular, his diet ordinary and plain: he had used soda-water, magnesia, and the alkalies, without any advantage. I proposed he should try a mild acid plan, and pointed out the requisite precautions that should be adopted to prevent the retention of a calculus in the bladder, but I have not been so fortunate as to hear any further particulars respecting this gentleman, who is resident in Ireland*."

Both this and the foregoing specimen contain sulphur.

Presented by W. T. Brande, Esq., 1842.

* W. T. Brande, Quarterly Journal of Science, vol. viii.

SERIES V.

CALCULI CONSISTING OF XANTHIC OXIDE, *Marcet.* URIC OXIDE, *Liebig.*

THE xanthic oxide, or as it has been more recently termed, the uric oxide calculus, is so extremely rare, that since the discovery of this remarkable substance by Dr. Marcet, only one other specimen has been described*.

Dr. Marcet's calculus was of a reddish cinnamon colour, its external surface was smooth, and its texture was hard, compact, and laminated: its weight did not exceed eight grains†. Of the history of this calculus nothing was known, and no portion of it can now be found.

The other specimen was extracted by Prof. Langenbeck from the bladder of an Hanoverian peasant boy, and its chemical composition was ascertained by Prof. Stromeyer shortly after its removal. For the most accurate account of this calculus, and of the properties of xanthic oxide in general, we are indebted to MM. Liebig and Wöhler‡, who have not only confirmed the accuracy of Dr. Marcet's statement with regard to the peculiar nature of this substance, but have also carefully determined its elementary composition§.

This calculus was of a flattened oval figure, and about the size of a small hen's egg; its surface was partly of a light-brown colour, smooth and polished, and partly pale and earthy: when broken it was of a brownish flesh-colour. It was composed of concentric layers, readily separable from each other, but without any appearance of a crystalline or fibrous structure. It had a distinct nucleus, which did not differ in composition from the rest of the calculus. In point of hardness it resembled uric acid calculi in general, and it acquired a waxy lustre when rubbed or scraped.

As the xanthic oxide of the calculus was necessarily mixed with some of the

* A small calculus, weighing only a centigramme, has been noticed by M. Laugier as consisting of xanthic oxide.—*Archives Générales*, xxi. p. 145.

† Essay on Calculous Disorders.

‡ Through the kindness of Dr. Willis, a portion of the specimen examined by Liebig and Wöhler has been deposited in this Collection. (Vide Plate XII. figs. 1, 2.)

§ Poggendorff's *Annalen*, B. xli. s. 393.

constituents of the urine, MM. Liebig and Wöhler procured it in a state of sufficient purity for its ultimate analysis, by dissolving the calculus in a solution of caustic potass, and passing a current of carbonic acid gas through the mixture. The xanthic oxide was completely precipitated as a white powder, which when dried, formed hard masses of a pale yellow colour, and which acquired a resinous lustre by slight friction.

Thus prepared, xanthic oxide was found to have the same elementary composition as uric acid, minus one atom of oxygen*. The relation between these two bodies is therefore very close, and the formation of xanthic oxide probably depends upon an imperfect oxidation of the material from which, by the ordinary processes of the kidney, uric acid is eliminated.

On the supposition that uric acid and xanthic oxide are compounds of the same radical with different proportions of oxygen, MM. Liebig and Wöhler have given to this substance the name of uric oxide.

The chemical properties of xanthic, or, as it may be more properly denominated, uric oxide, resemble very nearly those of uric acid; there are, however, several characteristic peculiarities by which these substances may be readily distinguished, and even separated from each other, should they ever be found in a state of mixture. Of these the most striking are its action with nitric and sulphuric acids.

Uric oxide dissolves without effervescence in warm nitric acid; the solution, on evaporation to dryness, leaves a lemon-yellow residue, which is partially soluble in water. If ammonia be added to the residue it is dissolved, and the solution acquires a reddish brown colour, which is quite distinct from the pink solution procured by the action of these reagents on uric acid. These effects are also produced when uric oxide is mixed with a large proportion of uric acid; indeed, the presence of uric oxide appears in a great measure to prevent the formation of the pink colour, causing it to assume a brick-red tint. The ammoniacal solution regains its former yellow tint by evaporation to dryness.

In concentrated sulphuric acid uric oxide entirely dissolves; the solution is slightly yellow, and is not rendered turbid by dilution with water: uric acid, on the other hand, is copiously precipitated on the addition of water to its solution in sulphuric acid.

* For the ultimate composition of xanthic oxide, see the description of the uric acid calculus.

Uric oxide also differs from uric acid by its solution in potass not being precipitated by muriate of ammonia; moreover, when its solution in potass is supersaturated with carbonic acid, pure uric oxide is thrown down: uric acid, on the contrary, is precipitated as a suburate of potass.

Uric oxide is readily dissolved by the pure and carbonated alkalis, and in a solution of ammonia it is even more soluble than uric acid. It is very sparingly soluble in hot water, and in the hydrochloric and oxalic acids.

The odour of the uric oxide calculus when burnt is peculiar, and differs both from that of uric acid and cystic oxide. When submitted to destructive distillation, it does not, like uric acid, yield any trace of urea.

Notwithstanding the close similarity in composition which exists between uric oxide and uric acid, these substances do not appear to have been found together in the same calculus. Should such a compound be met with, they may be readily separated from each other by dissolving the calculus in strong sulphuric acid, and diluting the solution with distilled water. The uric acid of the calculus is thereby precipitated, and after the mixture has cooled, is to be collected on a filter. To obtain the uric oxide, the filtered liquid is to be neutralized with ammonia and evaporated to dryness. By digesting the dry residue in cold water, sulphate of ammonia is dissolved, and the uric oxide remains in a state of tolerable purity*.

E. *Xanthic Oxide.*

E 1. A fragment of the calculus extracted by Prof. Langenbeck from the bladder of a peasant-boy aged eight years. The stone was broken into three pieces during the operation.

* Uric oxide, when purposely mixed with three or four times its weight of uric acid, has been separated by this process, and there is no doubt that it is sufficiently accurate for the purposes of ordinary analysis. In order to separate the uric acid as completely as possible, the solution, after the addition of the sulphuric acid, should be allowed to stand in a freezing mixture for several hours.

The patient completely recovered in about four weeks from the time of the operation *.

In external appearance this calculus differs from uric acid calculi in its texture being more compact, and having a fine earthy appearance. Its colour is also peculiar. (Vide Plate XII. figs. 1, 2.)

Presented by C. F. H. Marx, M.D., Prof. Med. Götting., at the request of Dr. Willis, 1842.

SERIES VI.

CALCULI CONSISTING OF PHOSPHATE OF LIME.

Phosphate of lime is a constituent of healthy urine, and is readily precipitated from that fluid on the addition of an alkali. This salt is therefore held in solution in the urine by a free acid, and is most probably combined with an excess of phosphoric acid, forming a soluble acid or super-phosphate of lime †.

Calculi consisting entirely of phosphate of lime, having an undoubted renal origin, are of extremely rare occurrence. There is no specimen of this description in the present Collection, nor does it in any instance form the nucleus of a calculus. As a principal constituent of urinary concretions, however, this substance is very common. It is most frequently found mixed with phosphate of magnesia and ammonia, forming the white chalky-looking mass denominated by Dr. Wollaston the ***Fusible Calculus.*** In minute and unimportant quantities, this salt is to be detected in almost every species of calculus.

The concretions which are found within the cells of the prostate gland, and

* Poggendorff's *Ann.*, b. xli. s. 393.

† Phosphate of lime is sometimes precipitated from the urine on the application of heat. For the circumstances under which this effect takes place, and its probable causes, see Prout on Stomach and Urinary Diseases; London Medical Gazette, vol. xvii. p. 847; and Guy's Hospital Reports, vol. i. p. 401.

which consist of nearly pure phosphate of lime, form no exception to this statement. They cannot be regarded as of urinary origin, since calculi of a precisely similar description are sometimes found in the interior of cysts and abscesses, within the substance of the prostate, having no communication with the bladder or any part of the urinary passages.

Phosphate of lime appears to be much more frequently derived from the mucous membrane lining the bladder and the pelvis of the kidney, than as a secretion from the glandular texture of that organ. There can be, however, little doubt that in many cases this salt is secreted by the kidney in a larger proportion than natural, and that although it is rarely precipitated from the urine so as to form an independent concretion, yet, when other calculi are present in the bladder, the excess of earthy phosphate is deposited upon them, and in this manner gives origin to the layers of pure phosphate of lime which are not unfrequently observed in urinary calculi.

It is also probable, that in a great many cases, the phosphate of lime existing naturally in the urine is simply precipitated from it by an alkaline condition of the urine itself, or by alkaline mucus secreted by the bladder, as will be more fully explained in the description of the fusible calculus. To one or other of these sources, either alone or conjoined, the presence of phosphate of lime in urinary concretions is to be referred; and it will probably facilitate description, if the characters of the earthy deposit in each of these cases be separately considered, as far as they can clearly be distinguished.

As a secretion from the Kidneys.

It has been already remarked, that phosphate of lime rarely, if ever, forms an original deposit from the urine except in combination with other substances. The only description which has been given of this salt as constituting an entire urinary calculus is that by Dr. Wollaston in the Philosophical Transactions for 1797, and is as follows:—"Its surface is generally of a pale brown, and so smooth as to appear polished; when sawed through, it is found very regularly laminated, and the laminæ in general adhere so slightly to each other, as to separate with ease into concentric crusts. In a specimen with which I was favoured

by Dr. Baillie, each lamina is striated in a direction perpendicular to the surface, as if from an assemblage of crystalline fibres*."

It is not however, uncommon to find in urinary calculi layers of phosphate of lime surrounding a nucleus of some other substance. The phosphate of lime in these layers is generally very pure, and usually differs both in appearance and composition from that which is found mixed with the mucus of the bladder in the form of amorphous friable masses, or as it ordinarily appears in the concretions from the prostate gland. The structure of the former is usually crystalline, as is shown in Plate IX. fig. 9, where the calcareous salt, in the form of radiating fibres, surrounds a nucleus of oxalate of lime. Sometimes the crystalline structure is indistinct, and its texture is more compact, as in the calculus figured in Plate II. fig. 8.

These layers, when heated before the blowpipe, fuse without much difficulty into an opake globule, although they do not contain any appreciable quantity of the triple phosphate; while the latter and more common form of the phosphate of lime deposit resists the utmost heat of the mouth-blowpipe: nor does it present a distinct crystalline texture. This difference in their relative fusibility arises from the crystalline variety containing a larger proportion of phosphoric acid than is present in the other variety. The latter appears to be similar in composition to the earth of bones; while the former resembles, in its external appearance and fusibility, the concretions from the intestinal canal of animals which are composed of diphosphate of lime. From all these circumstances, it may be fairly inferred that the phosphate of lime of these layers has been deposited from a state of solution in the urine, and that they are consequently of renal origin.

* Calculi, precisely similar in structure and composition to those described by Dr. Wollaston, are very frequently found in the intestinal canal of graminivorous animals. These concretions, however, are in general to be distinguished from those having a urinary origin, by their almost invariably having some foreign body, as a nail, a piece of wood or straw, for their nucleus. Of these concretions there is a large collection in the Museum.

E. A. Scharling, under the head of Phosphate of Lime, observes, "Hunc salem Wollaston primus in calculis humanis invenit: descriptio ejus talium calculorum accuratissime cum numeris 72 et 104 in collectione Academiæ Chirurgicæ nostræ convenit, quamobrem liceat verba hujus clarissimi chemici citare."—*De Chemicis Calculorum Vesicariorum Rationibus*, p. 22, 1829. Of these two specimens drawings are given, and from their general appearance and their having a fragment of wood for their nucleus, there can be no doubt of their intestinal origin.

Phosphate of lime has in two instances been observed by Dr. Prout to be deposited from the urine as an impalpable powder, in very large quantities and of considerable purity, when no disease of the bladder was present.

As a secretion from the Mucous Membrane of the Urinary Passages.

It has been remarked by Dr. Prout and by Sir B. Brodie, that in certain forms of disease of the bladder, its mucous follicles throw off large quantities of phosphate of lime mixed with carbonate of lime. These salts concrete into irregular masses resembling mortar, or they form a granular semi-crystalline powder; they are usually enveloped in a thick tenacious mucus, which has an alkaline reaction from the presence of carbonate of soda, while the urine itself is frequently acid. To a similar morbid secretion from the mucous membrane is probably to be attributed a large proportion of the phosphate of lime of the fusible calculus, especially in those cases where it is accompanied by carbonate of lime.

Calculi from the Prostate Gland.

Prostatic concretions most commonly occur in the form of small rounded grains, compared by Dr. Wollaston to grains of pearl-barley, from their pearly semi-transparent appearance. These concretions are found in the cells of the prostate gland. They are generally tinged of a yellowish brown colour by the secretion of the gland, and are sometimes very numerous; as these calculi increase in size, absorption of the gland takes place, and they become more or less irregular in figure. They consist of phosphate with a little carbonate of lime, and animal matter. (Vide Plate VIII. fig. 5.)

Calculi consisting of phosphate of lime are sometimes found in cysts and in abscesses of the prostate gland. These concretions often attain a considerable size; their surface is generally smooth, and sometimes highly polished, resembling porcelain. When more than one calculus is present, they present articulating surfaces at the points where they have been in contact one with another. When divided, these calculi sometimes exhibit a radiated and laminated

structure, while the structure of others is compact, and their fracture conchoidal.

In those cases in which complete disorganization of the structure of the prostate gland has taken place, and it is reduced to a mere cyst, the calculi which are found in its cavity often consist of the fusible calculus, or at least contain more or less of the triple phosphate. Of these concretions there are several specimens in the Museum, one of which is figured in Plate VIII. figs. 8, 9, 10.

The relative proportion of phosphoric acid and lime in all the varieties of this calculus appears to vary considerably, although they may in all probability be reduced to two salts;—the neutral phosphate of lime, or the diphosphate, which exists in those varieties that are partially fusible before the blowpipe and which generally exhibit a crystalline structure; and the basic phosphate of lime, or the earth of bones, which is completely infusible by the mouth-blowpipe. In estimating the fusibility of these compounds, care must be taken that none of the triple phosphate is present.

When heated before the blowpipe, the phosphate of lime calculus chars, and is quickly converted into a grey ash, which retains its form and does not render turmeric paper brown.

It is readily soluble in nitric and muriatic acids, sparingly so in acetic acid; the acid solutions, on being neutralized by ammonia, deposit the phosphate of lime in the gelatinous state. The precipitate, when collected on a filter and dried, forms a brittle horny mass.

Oxalate of ammonia added to its diluted solution causes a white precipitate of oxalate of lime; the solution must not, however, contain a great excess of acid. From carbonate of lime this salt may be separated, by dissolving the compound in muriatic acid, and adding ammonia to the solution; phosphate of lime is thereby precipitated, while the lime that was in combination with carbonic acid remains in solution, and may be thrown down by the addition of oxalate or carbonate of ammonia.

F. *Phosphate of Lime.*

F 1. Some small irregularly-shaped concretions, taken from the cells of the prostate gland.

Phosphate with a trace of carbonate of lime.

Presented by James Briggs, Esq., 1832.

F 2. Numerous small calculi taken from the prostate gland of a man, aged 61.

The patient had occasionally experienced difficulty in voiding his urine, and for a long time it had always passed in a small stream. Retention of urine finally came on, which was relieved by the use of the catheter, although not until several ineffectual attempts to introduce the instrument had been made. About a week after, the patient was seized with rigor and hiccough. He died on the following day.

On examination, the catheter was found to have been forced through the membrane lining the urethra in two places; in one a false passage had been made into the bladder, and in the other a passage three inches long into the corpus spongiosum. The membranous portion of the urethra was inflamed, and some calcareous matter was found adhering to it; the surrounding parts and the bulbous portion were nearly in a state of mortification. There was no stricture. The prostate gland was enlarged and contained a great number of small calculi: calculi were also found in several small cysts in the substance of the gland, which were partly filled with pus. *Mus. Taunton*, 1841.

F 3. Some small round calculi, composed of phosphate mixed with carbonate of lime. They have been doubtless taken from the prostate gland.

Presented by W. T. Brande, Esq., 1841.

F 4. Several small calculi which were voided at different times, during a period of five months, by the urethra of a man.

Phosphate, with some carbonate of lime.

Presented by J. H. Green, Esq., 1842.

SERIES VII.

CALCULI CONSISTING OF PHOSPHATE OF MAGNESIA AND AMMONIA.

PHOSPHATE of magnesia and ammonia is deposited from the urine, either in the form of a shining white crystalline powder, termed *white gravel*, or as a solid concretion. Whichever of these forms it assumes, it is very rarely found in a state of purity, but is almost always mixed with phosphate of lime.

In this Collection there are only three calculi composed entirely of the magnesian phosphate; while there are no less than forty-five specimens which consist of this salt in combination with phosphate of lime.

The phosphate of magnesia and ammonia, or the triple phosphate calculus, as it has been termed for the sake of brevity, usually appears as a white crystalline mass, radiating from the centre, and having its surface studded with the summits of shining crystals, which when recent are nearly transparent, but by exposure to the air lose their lustre, and become opake. It is also found of an earthy and easily friable texture, and having an imperfect lamellar structure. In some instances it is hard, compact, and semi-transparent, breaking with a crystalline fracture, and resembling alabaster in appearance. (Vide Plates VII. figs. 2, 3; VIII. fig. 7; X. figs. 5, 6.)

Crystals of the triple phosphate are very frequently found scattered over the surface of other concretions, or interspersed between their layers. This salt also very commonly forms large crystalline excrescences on the surface of the fusible calculus, which in lustre and appearance bear a considerable resemblance to pearl-spar.

The ammoniaco-magnesian phosphate is found in urinary deposits in the state of two distinct salts, containing different proportions of ammonia. One of these salts, the neutral triple phosphate, is distinguished by its crystalline form, which is derived from a right rectangular prism, and by the sharpness of outline which its crystals always present. This salt is the most common constituent of white-gravel, and, according to Dr. Wollaston, it usually assumes the form of a

short trilateral prism, having one angle a right angle, and the other two equal, terminated by a pyramid of three or six sides*. Very perfect crystals of this salt are found on the surface of urine which has been allowed to become slightly alkaline, or on the sides of the vessel in which it is contained. The same salt is also thrown down in the crystalline state, when a small quantity of ammonia is added to urine.

The other, the bibasic triple phosphate, appears under the microscope in a stellated form, sometimes having a foliated appearance. It appears to be deposited from the urine whenever that fluid is highly alkaline, and may be formed artificially by adding an excess of ammonia to the urine. These salts sometimes form an iridescent pellicle on the surface of the urine, and they are almost invariably mixed with phosphate of lime.

Phosphate of magnesia and ammonia does not form one of the saline constituents of the urine, but is probably, in every instance, produced by the combination of ammonia, evolved either by the decomposition of the urine, or perhaps secreted in the form of carbonate of ammonia, with the phosphate of magnesia existing naturally in the urine. Dr. Prout considers the triple phosphate to have almost always an urinary origin, and this opinion appears to be in accordance with general experience.

The constitutional symptoms attending the deposition of this salt are, according to Dr. Prout, characterized in all well-marked cases by great nervous irritability, with a sense of fatigue and exhaustion on the slightest exertion, and by pains in the back, with general debility†.

When heated before the blowpipe, the triple phosphate calculus gives off water and ammonia, and diphosphate of magnesia is left, which fuses with difficulty into a white porous enamel. If a small portion of phosphate of lime be added, fusion takes place with the greatest readiness. It is readily soluble in diluted acetic and in the mineral acids, and from these solutions it is readily thrown down in a crystalline state on the addition of ammonia.

When digested in a boiling solution of caustic potass, ammonia is expelled.

The substances with which this salt is most frequently mixed in urinary deposits are phosphate and carbonate of lime, urate of ammonia, and animal

* Phil. Trans., 1797.

† Prout on Urinary Diseases, p. 269, 3rd edit.

matter. The mode of separating and distinguishing these bodies from one another will be described under the head of the Fusible Calculus, where some further observations on its origin will also be found.

The existence of phosphate of magnesia and ammonia in urinary concretions was first discovered by Dr. Wollaston in the year 1797*.

G. *Phosphate of Magnesia and Ammonia.*

G 1. A large renal calculus composed of phosphate of magnesia and ammonia, with a very small proportion of phosphate of lime. (Vide Plate X. figs. 5, 6.)

This calculus weighs seven ounces four drachms, and "was taken from the pelvis of the right kidney of Mrs. ———, a natural daughter of Sir Richard Steele: she was never known to have a nephritic symptom till just before her death, when she was taken with a violent pain in her right side, near to the back, the seat of the right kidney, which appears to have thrown her into a fever of which she died; and upon opening the body was found this stone, filling up an enlarged pelvis, and the substance of the kidney itself become so thin as only to appear like a coat or membrane covering the stone, which gave the idea to the surgeon, that the substance of the kidney was grown into a stone."—*Original Memorandum by Mr. Hunter.* *Hunterian.*

G 2. A small oval calculus consisting of crystallized triple phosphate. *Hunterian.*

G 3. A portion of an urinary calculus from the human bladder consisting of phosphate of magnesia and ammonia. The triple phosphate is in the form of radiating crystals surrounding a small nucleus of the mixed phosphates. It contains a small quantity of phosphate of lime, and of urate of ammonia.

"From Dr. Groenvelt by Mr. Mason."—*Sloanian MS. Catalogue.* (Vide Plate VIII. fig. 7.) *British Museum.*

* Phil. Trans.

G 4. A small calculus composed of crystallized phosphate of magnesia and ammonia.

Extracted by an operation from the bladder of John Low, aged 2 years and 4 months. *Presented by Dr. U. Cumin*, 1842.

SERIES VIII.

CALCULI CONSISTING OF PHOSPHATE OF LIME AND PHOSPHATE OF MAGNESIA AND AMMONIA MIXED IN VARIOUS PROPORTIONS. THE FUSIBLE CALCULUS, *Wollaston.*

It has been already observed, that phosphate of lime and phosphate of magnesia and ammonia are very rarely deposited from the urine in a separate state, but are usually found mixed together.

To the compound thus formed, Dr. Wollaston, by whom its composition was first accurately ascertained, gave the name of the fusible calculus, from its property of readily melting before the blowpipe into a pearly, semi-transparent or opake globule.

The fusible calculus is usually of a whiter colour, and of a more friable and earthy texture than any other species. It is frequently composed of concentric laminæ, which in general adhere but slightly to each other. Between its laminæ shining crystals of the triple phosphate are often to be observed. In some specimens the lamellar structure is entirely wanting, and it forms a white friable mass resembling chalk in appearance; in others, the texture is semi-crystalline, as if made of a number of small crystals confusedly aggregated together.

These calculi are extremely irregular in figure, as they readily mould themselves to the cavity in which they are formed: they often attain a very large size. and are sometimes found occupying nearly the entire cavity of the bladder;

in these cases the impressions of the mucous membrane may be traced on their surface, as is shown in the specimen (H 2). When more than two calculi are present in the bladder, they generally acquire a regular cubic, or tetrahedric figure.

The relative proportion of the constituents of this calculus is exceedingly various, and the predominance of one or the other salt gives peculiar characters to the calculus: in those calculi which have a crystalline and glistening texture, the triple phosphate is found to be most abundant; while the calcareous phosphate is generally in excess in those specimens which possess an amorphous and earthy appearance.

Calculi consisting of the mixed phosphates are found in every part of the urinary organs. They frequently occur in a large cyst or cavity in the prostate gland, extending sometimes into the membranous portion of the urethra, which becomes excessively dilated. In these cases the calculus has usually an elongated somewhat conical figure, and consists of two or three separate portions which are closely adapted to each other, and have polished articulating surfaces at the point of contact. The rounded extremity of one calculus is very often received into a corresponding concavity of another. These calculi almost always contain a larger proportion of phosphate and carbonate of lime than those found in any other situation; the calcareous salts being doubtless derived principally from the membrane lining the cavity, while the magnesian phosphate is deposited from the urine. H 13, 15, 23.

The fusible calculus is not very uncommon; it forms rather more than one-twelfth part of the calculi in this Collection; as a secondary deposit it is of much more frequent occurrence.

One of the most remarkable circumstances connected with the deposition of the earthy phosphates is, that these salts, whether in their separate or combined state, are very rarely succeeded by any other species of urinary deposit; indeed, so constant is this fact, that it may safely be assumed as a general law. The only exception to this statement in the present Collection is the calculus figured in Plate IX. fig. 7, where layers of the fusible compound are found in a mulberry concretion. A still more striking instance exists in the Museum of St. Bartholomew's Hospital, in which the fusible calculus is surrounded by a thick layer of uric acid: a section of this calculus is figured in Plate XII. fig. 11.

As a secondary deposit, the fusible compound is of very common occurrence; indeed, few calculi remain for any considerable time in the bladder without becoming incrusted by these salts. The uric acid calculus appears to be the least prone to be followed by the phosphatic diathesis. Similar effects are also produced by the introduction of any foreign body into the bladder, of which there are numerous examples in this Collection. In all these cases, it is most probable that the solid body produces, in the first instance, irritation of the mucous membrane lining the bladder, and that a secretion of alkaline mucus with phosphate and carbonate of lime takes place; at the same time, or very shortly after, the irritation is communicated to the kidney, which causes the urine to abound in the phosphates. This view derives some probability from the circumstance that, in many calculi, that portion of the outer coat which is nearest the nucleus contains a larger relative proportion of phosphate of lime, than the exterior, which often consists of almost pure triple phosphate. Calculi also, which have kept one fixed position in the bladder, or have been closely embraced by it, frequently contain more phosphate and carbonate of lime at the surface with which they have been in contact with the mucous membrane, than at any other portion of the calculus.

In several instances it would appear that the deposition of the earthy phosphates is produced by an alkaline condition of the urine. In many of the cases in which the phosphatic diathesis prevails, the urea of the urine is not only found in an increased quantity, but also in a state exceedingly prone to decomposition; by the decomposition of this substance, a large quantity of carbonate of ammonia is generated, the alkali of which, uniting with phosphate of magnesia contained in the urine, gives rise to the production of the triple phosphate, while at the same time, by its saturating the acids of the urine, phosphate of lime is also precipitated. This decomposition of the urine, and consequent deposition of the earthy phosphates, frequently occurs when urine is detained in the bladder, either from paralysis of that organ, or from any mechanical obstruction, as from stricture, or calculus in the urethra.

The fusible calculus generally contains variable quantities of urate of ammonia, animal matter, carbonate and urate of lime, and uric acid. The two former substances are often present in very large quantities. When the calculus is dissolved in an acid, the animal matter is observed floating in the liquid, in

the form of loose flocculi; they consist, for the most part, of the mucus of the bladder.

The deposition of the earthy phosphates is commonly attended by the deposit of urate of ammonia. This substance is found in these concretions in two states; in one, it is intimately mixed with the other constituents of the calculus, so as not to be discoverable, except by chemical analysis; and in the other, it forms thin layers alternating with the earthy salts.

Calculi composed of the mixed phosphates are easily recognised by their property of fusing into a transparent or semi-opake globule.

When digested in very dilute sulphuric or acetic acid, the triple phosphate is dissolved, while the phosphate of lime remains behind; in this manner the relative proportion of the constituents of the calculus may be roughly estimated. In order to separate completely the calcareous from the magnesian phosphate, the calculus should be finely powdered, and digested in strong acetic acid; the whole of the triple phosphate is hereby dissolved, together with some phosphate of lime, while the greater proportion of the phosphate of lime is left undissolved. To the acetic solution oxalate of ammonia is to be added, which causes a precipitate of oxalate of lime. By adding ammonia to the clear solution, the whole of the magnesian phosphate is obtained in the state of phosphate of magnesia and ammonia. If carbonate of lime be also present, the earthy phosphates must, in the first instance, be precipitated together from the acetic solution, by the addition of ammonia; to the clear solution, oxalate of ammonia is then to be added, when the lime which was in combination with carbonic acid will be thrown down as oxalate of lime.

The precipitate consisting of the earthy phosphates is to be redissolved in acetic acid, and by the addition, first, of oxalate of ammonia, and afterwards, of ammonia, the two salts may be separated in the manner already described.

From urate of ammonia and urate of lime, the fusible calculus may be freed by digesting it repeatedly in boiling water.

The presence of phosphate of lime and phosphate of magnesia and ammonia in these calculi may be readily shown by dissolving a small fragment in muriatic acid, neutralizing by ammonia, and examining the precipitate produced by the microscope; the phosphate of lime appears as an amorphous granular precipitate, while the magnesian phosphate is in the form of stellated crystals.

H. *Mixed Phosphates.* *Fusible Calculus.* Wollaston.

H 1. A large and characteristic specimen of the fusible calculus of Wollaston. *Hunterian.*

H 2. Calculus taken after death from the bladder of Sir Walter Ogilvie, Bart. It weighs forty-four ounces troy, and measures sixteen inches around its long axis, and fourteen inches around its short axis. This calculus was examined by Dr. Powell, and found "to consist of the triple phosphate of ammonia and magnesia with phosphate of lime and a large quantity of animal matter." The central portion was less fusible before the blow-pipe than the general mass, and appeared to contain a larger proportion of phosphate of lime.

An account of this enormous, and very characteristic specimen of the *Fusible Calculus* is given by Sir James Earle in the Transactions of the Royal Society for 1809, p. 303, from which the following history has been abridged:—

"Sir Walter Ogilvie, Bart., of Dundee, an officer in the regiment of Scotch Greys, at the age of twenty-three, active and healthy, was crossing the ferry at Leith when he received a blow on his back from the boom of the vessel, which paralyzed the pelvis and lower extremities. During two months he was obliged to have his water drawn off; for fourteen months he remained in bed, in a horizontal posture; and though he recovered the use of his bladder and limbs sufficiently to walk across the room with the help of crutches, and also to ride, when placed on a low easy horse, his health continued many years in a weak and precarious state, while the limbs acquired little additional strength or power.

"About twenty years after the accident, perceiving symptoms of stone in the bladder, he was examined by Mr. Benjamin Bell at Edinburgh, and a stone was felt, which was judged to have attained a considerable size; the operation of extraction was then recommended, but was postponed from time to time, though his health declined and the irritation and pains in his bladder gradually increased.

"Sir Walter continued to endure this state of existence twenty-eight years from the time of the accident, when he became unable to make water in an erect position; this inconvenience increased to such a degree that latterly he could make none without standing almost on his head, so as to cause the upper part of his bladder to become the lower, and this he was obliged to do frequently, sometimes every ten minutes, as the quantity voided each time was less than the measure of a wine-glass, and when he used exercise, it was tinged with blood."

These symptoms continued to increase in severity until the spasms and fits of pain from the urgent desire to void urine became so frequent and violent, and rendered his life so completely miserable, that he determined, if possible, to have the stone extracted, and for that purpose came to London, and placed himself under the care of Sir James Earle, it being then thirty years from the time of the accident. At this period, the stone could be felt above the os pubis, forming a large prominent tumour, and on attempting to pass a sound, the instrument struck upon a solid mass which prevented its entering the bladder.

Mr. Cline being called into consultation, it was determined that an attempt should be made to extract the stone by the lateral operation; in the hope that the calculus would be found sufficiently soft to admit of its being broken down, and thus taken away; its magnitude precluding any idea of its being removed in an entire state.

Sir Walter being made perfectly aware of the difficulties to be apprehended in the extraction of the stone, and also of the uncertainty of the result, determined to submit to the operation, which Mr. Cline was requested to perform. "The staff could be passed in no further than the neck of the bladder; the division of the urethra and prostate gland was made with the scalpel and probe-pointed bistoury: when this was accomplished, it was found impossible to introduce any kind of forceps; but on pressing hard with the finger, part of the stone felt soft, gave way, and made some room for the forceps, which brought away several portions, and with the assistance of a scoop as much stone was extracted as would have filled a large tea-cup; but the great mass beyond what the finger could reach on either side still remained hard and impenetrable,

and after repeated trials with forceps of different kinds, and of the strongest powers, it was found impossible further to reduce the size of it, or take it away." The operation, which was necessarily protracted, was borne with great firmness; but the patient becoming much exhausted, it was judged right to relinquish any further endeavours to extract the stone. "No hæmorrhage ensued, he became calm and composed, and passed a tolerably good night; the next day he complained only of the same kind of spasms, and frequent pressing desire to void urine that he had been accustomed to feel," although they were not much more acute. On the third day from the operation peritonitis took place, which was subdued by bleeding and fomentations. From this time he appeared to improve in health and strength; his rest was, however, continually broken "by repeated spasms, which kept him in a constant state of irritation, obliging him to violent efforts in resisting them, and to get instantly on his knees with his head low in the bed, to enable him to expel the urine, one spasm frequently succeeding before the former had well subsided." "Towards the eighth day he was visibly growing weaker; his pulse smaller and quicker; his little inclination for food became less, and he was with difficulty prevailed on to take any; some cordial medicines however revived him; but on the following day he grew more impatient, feverish and restless, and on the tenth day after the operation, desiring not to be teased to take anything more, he covered himself completely with the bed-clothes, and quietly resigned his most singularly miserable existence."

Examination after death.—"On opening the abdomen the bladder was found much diseased and thickened, firmly embracing a stone of extraordinary magnitude, and appearing to be completely filled with it; on dividing the bladder from the os pubis backwards to the rectum, the stony mass was uncovered, which it was found impossible to remove with the largest forceps; with considerable difficulty it was raised by getting the hand beneath it, the cohesion between the bladder and the stone being very strong, although there did not appear to be any diseased or distinct adhesions. When taken out the form of the stone appeared to have been moulded by the bladder; the lower part having been confined by

the bony pelvis, took the impression of that cavity, and was smaller than the upper part, which having been unrestricted in its growth, except by the soft parts, was larger, and projected so as to lay on the os pubis. A large excavation had been made in the lower part, which lay on the neck of the bladder, by the operation. The kidneys were altered considerably in their texture, and their pelvis much enlarged; the left was pressed up higher than natural, and adhered firmly to the spleen. The right was attached to the ascending colon, and general adhesion had obtained between all the surrounding parts. The ureters were much increased in their dimensions and thickness, and were capable of containing a considerable quantity of fluid; they were in fact supplemental bladders, the real bladder having become nothing more than a painful and difficult conductor of urine, which trickled down in furrows formed by it on the superior surface of the stone. This clearly explained the cause which obliged the patient, when compelled to evacuate urine, to put himself in that posture which made the upper part of the bladder become the lower, by which means a relaxation or separation was allowed to take place between the bladder and the stone, so that the ureters had an opportunity of discharging their contents; when the body was erect the mouths or valvular openings must of course have been closed, by the pressure of the abdominal viscera on the bladder against the stone." *Presented by Sir James Earle*, 1808.

H 3. A fusible calculus, containing urate of ammonia.
Presented by Wm. Lynn, Esq., 1827.

H 4. A calculus taken after death from the bladder of a man between sixty and seventy years of age, who had laboured for several years under disease of the bladder and stricture of the urethra. This specimen consists of two portions: the larger rounded portion was contained in a pouch or cyst on the right side of the bladder, the only part perceptible when the bladder was laid open being the narrow broken part of the neck, closely embraced by the aperture of the pouch; the other portion was lying loose in the general cavity of the bladder, and had probably been broken off

before death. To this circumstance, perhaps, may be referred the aggravation of his symptoms a short time before his decease.

The portion of the calculus which was contained in the cyst consists of semi-crystalline grains of the fusible compound surrounded by concentric layers of the same, while the other consists principally of phosphate of magnesia and ammonia. *Presented by James Briggs, Esq.*, 1832.

H 5. A section of an oblong conical-shaped calculus, consisting chiefly of the mixed phosphates. *British Museum*, 1809.

H 6. A section of a calculus composed of phosphate of lime with a little phosphate of magnesia and ammonia. *Hunterian.*

H 7. A small calculus, consisting of the mixed phosphates deposited upon crystallized phosphate of magnesia and ammonia. *Hunterian.*

H 8. "A very remarkably shaped stone cut out of a lad in St. George's Hospital." (Vide Plate X. figs. 1, 2.)

This calculus was lodged partly in the urethra and partly in the bladder; it is composed almost entirely of the mixed phosphates, and is described and figured in Wm. Bromfield's 'Chirurgical Observations and Cases,' vol. ii. plate 10. *Presented by John Gunning, Esq.*, 1816.

H 9. Two triangular-shaped calculi, consisting of the mixed phosphates with some urate of ammonia. *British Museum.*

H 10. Two large angular calculi with smooth articulating surfaces; they consist of phosphate of magnesia and ammonia, with a little phosphate and carbonate of lime.

From the British Museum, with the following memorandum: "Calculi ex prolapsa uteri vagina, cui vesica urinaria inclusa, post mortem ægræ anno 1770 excisi, die 28 Jan. in pago Weidel ducatus Luneburg. From Dr. Steigertahl."—*Sloanian MS. Catalogue.*

H 11. "A large flattened triangular stone, taken out of the vagina of a woman. Given to me by Mr. Freke, surgeon."—*Sloanian MS. Catalogue.*

In the original memorandum this calculus is said to have increased in size by the urine from the meatus urinarius flowing over it. If the

history is correct, it is more probable that the patient had vesico-vaginal fistula. It is composed of concentric layers of the fusible calculus mixed with a considerable quantity of uric acid and urate of ammonia.

British Museum, 1809.

H 12. A calculus of a very elongated and unusual form, consisting principally of the phosphate of magnesia and ammonia. (Vide Plate X. figs. 3, 4.)

Hunterian.

H 13. One large and three small calculi, having articulating surfaces; these calculi were taken from the prostate gland, which was converted into a cyst: they consist of the mixed phosphates with a little urate of ammonia and carbonate of lime, and weigh 575 grains. One of these calculi protruded about one-tenth of an inch into the cavity of the bladder, through an ulcerated opening situated anterior to the natural opening of the urethra. That portion of the bladder and urethra which contained the calculi is preserved in spirit. (Vide Plate VIII. figs. 8, 9, 10.)

Presented by Wm. Lawrence, Esq., 1817.

H 14. Two vesical calculi, apparently taken from the same bladder; they consist of the earthy phosphates mixed with carbonate of lime and urate of ammonia. *Presented by Sir Wm. Blizard.*

H 15. "Two calculi extracted from the urethra of a patient aged 60, in St. George's Hospital. The larger calculus was situated in the membranous part of the urethra; the smaller about three inches from the external orifice, the urethra being dilated into a cyst at each of these parts. The patient supposed himself to have laboured under strictures of the urethra for ten years: at last there was complete retention of urine; the urine became effused behind the smaller calculus, and mortification of the skin of the penis and scrotum took place to a considerable extent, and the man died, November 1816.'

Both of these calculi are composed of the earthy phosphates mixed with carbonate of lime and animal matter. One extremity of the smaller calculus, which is of a conical figure, has a porcelainous appearance, and consists of nearly pure phosphate of lime.

Presented by Sir E. Home, 1816.

H 16. Several calculi, consisting of the mixed phosphates. They formed part of twenty, and were accompanied by the following memorandum:—"Taken from a man 76 years old; the largest from the bladder, the others from the perinæum." *Presented by Everard Home, Esq.*, 1807.

H 17. A calculus consisting of the mixed phosphates, with some urate of ammonia. *Presented by Everard Home, Esq.*, 1807.

H 18. An oblong concretion, consisting of two calculi closely united together.

Fusible compound containing urate of ammonia. *Hunterian.*

H 19. Several angular calculi, and portions of calculi, some of which were discharged at an opening in the inferior and posterior part of the scrotum, and the others extracted from the urethra by Mr. G. Wilkinson, who presented them to Mr. Hunter.

Mixed phosphates with a little carbonate of lime; some of the fragments contain urate of ammonia. *Hunterian.*

H 20. A fusible calculus, containing a large proportion of urate of ammonia. *Hunterian.*

H 21. Fragments of a large calculus, consisting of the fusible compound mixed with carbonate of lime and urate of ammonia.

Presented by the Executors of the late Mr. Long, 1818.

H 22. Phosphate of lime mixed with phosphate of magnesia and ammonia; the exterior consists principally of phosphate and carbonate of lime. *Hunterian.*

H 23. Two calculi of considerable size, having smooth surfaces adapted to each other. "From the urethra of a young man."

These calculi were most probably taken from a large cyst in the prostate gland. They are composed of the fusible compound, containing a large proportion of phosphate and some carbonate of lime.

Presented by Sir Wm. Blizard, 1811.

H 24. Phosphate of magnesia and ammonia, with a little phosphate of lime. *Hunterian.*

H 25. Phosphate of magnesia and ammonia mixed in various proportions with

phosphate and carbonate of lime; the inner portion contains more carbonate of lime than the outer. *Presented by Wm. Lynn, Esq.*, 1827.

H 26. Fragments of a fusible calculus, taken after death from the bladder of a man who died in St. George's Hospital. *Hunterian.*

H 27. A renal calculus, composed of phosphate of lime mixed with phosphate of magnesia and ammonia, and carbonate of lime; a narrow irregular layer of oxalate of lime forms one of the outer layers of this calculus.
Presented by John Gunning, Esq., 1816.

H 28. A calculus taken from the bladder of a female body which Mr. Hunter had for dissection, 1759. It consists of the mixed phosphates.
Hunterian.

H 29. A fusible calculus having an articulating surface.
"From Dr. Groenvelt by Mr. Mason."—*Sloanian MS. Catalogue.*
British Museum, 1809.

H 30. A small oblong calculus, consisting of the mixed phosphates.
Presented by Sir Wm. Blizard, 1819.

H 31. A section of a fusible calculus, containing thin layers of urate of ammonia. *British Museum*, 1809.

H 32. Twenty-one angular calculi, composed of phosphate of magnesia and ammonia mixed with phosphate of lime, uric acid, and urate of ammonia. The centre of each calculus consists of the triple phosphate crystallized.

"An old negro woman in Demerara made an incision into the urethra of a negro boy of four years of age, and extracted these calculi, and made a perfect cure of her patient. James Hendy." *Hunterian.*

H 33. Two small renal calculi, consisting principally of phosphate of lime.
Hunterian.

H 34. A fusible calculus which was contained in a portion of the bladder that protruded through the abdominal ring into the scrotum, and was removed during life by Mr. Percival Pott. The calculus is surrounded by the portion of the bladder which formed the cyst. The following history of the case has been abridged from Mr. Pott's Chirurgical Works, 4to edit., 1775, p. 789.

"A boy about six years old was seized with an acute pain about the region of the pubes: it lasted near an hour and a half, and suddenly ceasing he became perfectly easy. During the time his pain lasted he could not discharge a drop of water, though he endeavoured so to do, but as it ceased he pissed freely. In a few days after a small tumour was discovered, about the size of a pea, in the spermatic process just below the groin; it gave the child no pain, and therefore no notice was taken of it." When about thirteen years of age the boy was examined by Mr. Pott, who found the swelling to be perfectly equal as to its surface, indolent, and of a stony incompressible hardness; it was troublesome from its weight, but never occasioned pain in the back or loins; it had every appearance of being dependent from the spermatic process, which was larger than natural, although the cord had neither the feel nor the appearance of being diseased. As the tumour was now troublesome upon motion, and manifested a disposition to increase in size, it was resolved to remove it. An incision was therefore made through the skin, and cellular membrane, the whole length of the process and scrotum, when a firm white membranous bag or cyst was exposed, connected loosely with the cellular membrane, and which, on being traced upwards, became narrower, and was found "to be dependent from, and continuous with, a membranous duct, about the breadth of the largest wheat-straw, or what it was more like to, a human ureter, which passed out from the abdomen through the opening in the muscle." The testicle lay immediately behind the tumour, and was small, flat, and compressed.

On dividing the duct immediately above the tumour, about four ounces of a clear fluid issued, and the mouth of the cyst expanding itself, disclosed a stone exactly resembling what is found in the human bladder. In order to be certain that the cyst was connected with the bladder, the boy was desired, after some time, to make water; when a large stream of urine flowing through the wound, instead of the urethra, put the matter beyond all doubt. "The patient was dressed superficially; he had no bad symptoms, his urine came through the wound in his groin for about a fortnight, but as the wound healed it resumed its natural course; since which time he has remained free from complaint, except that the

natural size of the bladder being lessened by the extirpation of a part, he is obliged to discharge his urine rather more frequently."

Presented by Henry Earle, Esq., 1818.

H 35. The fragments of a calculus which weighed when dry six drachms one scruple.

The earthy phosphates, mixed with a large quantity of urate of ammonia. *Presented by Everard Home, Esq.*, 1807.

H 36. A portion of a calculus, consisting of the mixed phosphates.

Hunterian.

H 37. A small fusible calculus. *Presented by Sir Wm. Blizard.*

H 38. Two portions of the outer crust of a vesical calculus, consisting of the mixed phosphates. *British Museum*, 1809.

H 39. The fragments of a fusible calculus, which was taken from a man in St. George's Hospital. Being very soft, it broke down during the operation. The patient had had stricture of the urethra for a considerable time. *Presented by Everard Home, Esq.*, 1807.

H 40. A section of a small calculus, consisting of the mixed phosphates.

Presented by Everard Home, Esq., 1807.

H 41. A small calculus, consisting of the mixed phosphates with a little urate of ammonia. *Presented by Sir Wm. Blizard*, 1819.

H 42. A small fusible calculus. *Presented by Wm. Lynn, Esq.*

H 43. "Portions of a calculus from a man aged 63, in St. George's Hospital."

Phosphate of lime, with carbonate of lime and a little phosphate of magnesia and ammonia. *Presented by Everard Home, Esq.*, 1807.

H 44. A small oblong calculus which was voided by the urethra. It is composed of the mixed phosphates.

Presented by W. T. Brande, Esq., 1842.

H 45. Three small fusible calculi. *Presented by W. T. Brande, Esq.*, 1842.

H 46. Two calculi, about the size of large almonds, and of an elongated pyriform figure; their surface is irregular and nodulated, and they are com-

posed of phosphate of lime mixed with phosphate of magnesia and ammonia. These calculi, with another of a similar description, were removed from the bladder of Peter Grant, aged 79, by Mr. Liston. The patient recovered. *Mus. Liston*, 1842.

H 47. Numerous small calculi, composed of phosphate of lime mixed with phosphate of magnesia and ammonia, urate of ammonia, and urate of lime: their external surface is coated by a thin layer of impure urate of ammonia. These calculi are also accompanied by several small masses of calculous concretion, resembling mortar in appearance, which consist of the phosphates mixed with carbonate of lime.

Removed by Mr. Liston, from the bladder of Alexander Bain, aged 74. The patient had laboured under symptoms of stone for several years, and was much exhausted. He died on the tenth day after the operation, with gastro-enteritic symptoms. *Mus. Liston*, 1842.

H 48. Two triangular calculi, consisting of the mixed phosphates. These calculi were part of seven that were voided by the urethra of an old lady seventy-four years of age. The patient had suffered for a short time previous from symptoms of stone, with incontinence of urine, the urine being occasionally sanguineous. The calculi were expelled without much difficulty at intervals of a month, and generally two at a time. They measure about an inch across. *Presented by H. T. Elliott, Esq.*, 1841.

H a. *Earthy Phosphates deposited on foreign bodies which have been introduced into the bladder.*

There is no fact better established in our knowledge of calculous concretions than that foreign bodies, when introduced into the urinary passages, become sooner or later incrusted by the earthy phosphates*. The usual explanation of the nature of the changes which take place under these circumstances, is as fol-

* Fourcroy, System of Chemistry, translated by W. Nicholson, vol. x. p. 306. T. Thomson, System of Chemistry, 1802. Marcet, *op. cit.* 1817. Prout, *op. cit.* 1821.

lows, although some difference of opinion still exists as to the source from which the phosphate of lime is derived* :—

The presence of the foreign body in the bladder, excites chronic inflammation of its mucous membrane, which is accompanied, as in other cases, by a copious secretion of mucus from its surface. It is also well known that long-continued inflammation of the bladder, however induced, always produces in the urine a redundancy of the phosphates. The usual consequences of such a state of things ensue; the secretion from the bladder becomes purulent and highly alkaline, and is quickly followed by a deposit of the earthy phosphates, which attaching themselves around the foreign body, gradually form a phosphatic concretion.

To the almost universal law of the deposit of the earthy phosphates upon foreign bodies in the bladder, there is in this Collection one remarkable exception. In this case a slender piece of steel forms the nucleus of a large oval calculus consisting almost entirely of uric acid. (Vide Plate IV. fig. 6.) The tendency to the deposition of uric acid must have been exceedingly strong in the individual from whom this calculus was taken, since it has not only prevented the deposition of the phosphates, but has established and maintained, during the whole of the period required for the growth of the calculus, a diathesis of a totally opposite character.

H a 1. The mixed phosphates, deposited upon the larger end of a silver bodkin. This specimen is figured and described in Rymsdyk's 'Museum Britannicum,' from which the following history is taken :—" A silver bodkin, on the larger end of which is fastened an oblong stone as on a centre: this bodkin was thrust up the meatus urinarius of a woman on London Bridge troubled with the strangury, to ease her, where lying, it gathered this stone."—*Sloanian MS. Catalogue.* (Vide Plate XI. fig. 4.) *British Museum,* 1809.

H a 2. Two sections of a calculus consisting of the mixed phosphates deposited upon a sewing-needle. (Vide Plate XI. fig. 8.) *Hunterian.*

* W. Austin, Treatise on the Origin and Component Parts of the Stone, 1791. Murray Forbes, Treatise upon Gravel and upon Gout. Prout, *op. cit.* Brodie, *op. cit.* Martin, *De Lithogenesi,* pp. 106, 112.

H a 3. Fragments of a calculus, consisting of the mixed phosphates surrounding a pea.

"Mr. Addison's coachman, several years ago, in play, passed a pea up the urethra, which went on into the bladder. He was afterwards cut for the stone, and in the extraction it broke; upon examining it, the pea was found in a swelled state, and split into two halves in the calculus, which was oval; but the pea was nearer to one end, which was much softer than the other, and was that part which gave way, being more like wet sand contained in a shell, than a well-formed stone. A part of the shell of this end of the stone was left and afterwards came through the wound, and the man did very well; the portion that came away afterwards was about one-eighth of an inch thick and nearly half an inch square."—*Sir E. Home's MS. Surgical Cases.* (Vide Plate XI. fig. 3.) *Hunterian.*

H a 4. A contorted bougie, which was cut out of the human bladder, incrusted with the fusible calculus. *Presented by Everard Home, Esq.*, 1807.

H a 5. A contorted bougie, incrusted with calculous matter, which was extracted from a man's bladder. *Presented by Sir Wm. Blizard.*

H a 6. A bougie which had escaped from the urethra into the bladder; it is coiled up, and slightly incrusted by the mixed phosphates. (Vide Plate XI. fig. 1.) *Hunterian.*

H a 7. A small calculus on a portion of a hat-pin, "from the bladder of a woman;" but whether removed before or after death is not recorded. (Vide Plate XI. fig. 2.)

Mixed phosphates. *Presented by Sir Wm. Blizard.*

H a 8. The fragments of a calculus consisting of the mixed phosphates deposited upon a bougie. "This calculus was extracted entire by Sir Wm. Blizard, at the London Hospital, from a man about 20 years of age, on the 10th of April, 1805. It was flattish, and of an oval figure. On a little pressure it burst to pieces, when a bougie was discovered in the centre, contorted, and pressed into a small compass. The pa-

tient said that he had frequently used bougies, on account of a disease in the urinary passage, and that at night, about a year before, he passed one into the bladder, and having neglected to bend or tye it, found in the morning that it had escaped, from which time he had experienced continual uneasiness in the bladder."

Presented by Sir Wm. Blizard, 1806.

H a 9. A calculus, consisting of phosphate of lime with phosphate of magnesia and ammonia, deposited upon a mass of margarate and oleate of lime. (Vide Plate XI. figs. 5, 6.)

The origin of this calculus is probably as follows:—On account of some real or supposed disease of the bladder, a solution of soap has been injected into its cavity; mutual decomposition between the soap and the salts of the urine has been the necessary result; the alkali of the former uniting with, and forming soluble compounds with the phosphoric and other acids of the urine, while the earthy bases of the urine have precipitated, in combination with the fatty acids of the soap, in the form of a semi-gelatinous sparingly soluble compound, being in fact an earthy soap; this substance, acting as a foreign body in the bladder, has induced the deposition of the phosphates, and given rise to the formation of a calculus. *Hunterian.*

H a 10. A calculus, similar in every respect to the preceding; the earthy soap constituting the nucleus is less in quantity and more transparent than is the case in the other specimen. (Vide Plate XI. fig. 9.)

Hunterian.

H a 11. This calculus was removed by Mr. Allaway from the bladder of a woman, the urethra being dilated with Mr. Thomas Blizard's dilator. The patient recovered perfectly.

Fusible calculus deposited on a piece of bone. (Vide Plate XI. fig. 7.) *Presented by Sir Wm. Blizard,* 1820.

H a 12. A portion of a bougie on which the mixed phosphates have been deposited. *Hunterian.*

H a 13. The lower part of a common glass tumbler, on the inside of which is a

thick crust of the earthy phosphates. This tumbler, in an entire state, was introduced into the vagina of an unmarried female, about twenty years of age. On her attempting to withdraw it, its upper edge was broken, by which the bladder was wounded, and incontinence of urine produced. In this situation it remained for nearly two years, when it was removed by Mr. Anthony White, who finding the tumbler to be closely embraced by the vagina, and quite immovable, broke away the sides of the glass with instruments having notches filed at their extremities like the wards of a key, until he was enabled to introduce a lever behind it. The glass was very much blackened, and the crust of calculous matter which lines its interior, was doubtless produced by the decomposition of the urine detained in the hollow of the tumbler.

On examination, a large horizontal slit was found in the bladder immediately above its cervix. *Presented by Anthony White, Esq.*

H a 14. Portions of a brass pin which formed the nucleus of a urinary calculus, and to one of which the phosphates still adhere.

The following particulars of the case were communicated by Anthony White, Esq. Robert Cole, twenty-two years of age, had suffered from pains in the loins, bladder, and urethra for the last two years, during which time he had been treated for a supposed disease of the kidney. His urine was frequently tinged with blood, and he carried his body bent forwards, the upright position always producing an aggravation of his symptoms. On examining the bladder with a sound, a large stone was felt, which was readily seized by the Lithotrity forceps, and measured twelve lines on the scale of the instrument. The stone was easily broken down by gentle blows with the hammer, but the smaller branch of the instrument could not by any means be brought in contact with the other branch, by nearly three lines and a half. On attempting to open the instrument, its branches were found to be so firmly fixed, that they resisted the most powerful efforts to separate them. The instrument was therefore withdrawn, in effecting which, however, the greatest difficulty was experienced; when the curved portion of the instrument had arrived at the neck of the blad-

der it remained fixed for a considerable time, but suddenly yielding, came with a violent jerk into the urethra, through which it was with difficulty drawn. The instrument being examined, its branches were found firmly wedged by two portions of the pin, which had been cut across. That portion of the pin on which the calculous matter still remains, was voided along with the urine on the following day.

The patient stated that he had swallowed a pin five years before, but that he had suffered no inconvenience from it until within the last two years, when he was attacked with pain in making water, &c.

Notwithstanding the force which was required to withdraw the instrument, the patient did not evince any increase of pain during the operation, and he completely recovered without any bad symptoms.

Presented by Anthony White, Esq., 1842.

H b. *Calculi in which the Phosphates have been succeeded by some other deposit.*

The phosphates, whether occurring as a primary or secondary affection, are so rarely succeeded by any other deposit, that it has been considered adviseable to deviate in these cases from the principle of the general arrangement, and to form them into a separate subclass.

H b 1. The central portion of this calculus consists of light-coloured oxalate of lime, the outer layers of which are extremely irregular; upon this has been deposited the fusible compound, which is surrounded by a narrow layer of oxalate of lime disposed in the form of radiating fibres. Its external surface is smooth, slightly tubercular, and of a very dark colour*. (Vide Plate IX. fig. 7.)

Presented by Mr. Long's Executors, 1818.

* A similar instance of the return to the oxalic diathesis after its having been suspended by that of the phosphates, is recorded by J. Wood, Lond. Med. and Ph. Journ., vol. lvii.

SERIES IX.

CALCULI CONSISTING OF CARBONATE OF LIME.

Carbonate of lime, as has been already remarked, is frequently found in small quantities in phosphatic concretions*, and in those consisting of oxalate of lime†.

Calculi, however, from the human subject, composed entirely of carbonate of lime, are of extremely rare occurrence, and have been noticed only by a few authors. The existence of such concretions was first pointed out by Brugnatelli, who describes forty-eight small concretions, which were extracted from the bladder of a young man. They were each about the size of a pea, possessed a lamellar structure, and broke with a shining fracture. The same author also mentions several ash-coloured calculi composed of carbonate of lime with a trace of carbonate of iron, that were taken after death from the bladder of a woman‡.

Dr. Prout has also seen small calculi of this salt which "were perfectly white and very friable§." A remarkable collection of these calculi is in the possession of R. Smith, Esq., Bristol, some of which have been represented in Plate XII. figs. 3, 4, 5, 6, 7 ||. Of these calculi, five were extracted by the lateral operation from the bladder of a boy, aged sixteen, by Mr. H. Sully; and the others, fifteen in number, were passed by the urethra of the same patient previous to the operation.

The former are exceedingly irregular in figure, their external surface is rough, and is dusted over with a white powder. The largest of these calculi was about

* First detected by Proust, *Ann. de Chem.*, t. xxxvi. p. 263, and subsequently by Yelloly, Phil. Trans., 1829, p. 78, Prout, and several others.

† Brande, Phil. Trans., 1808, p. 131; Prout on Stomach and Urinary Diseases; Ph. F. V. Walther, *Ueber die Harnsteine, &c.*; Brugnatelli, *Arch. Gen. de Med.*, vol. iii. p. 445.

‡ *Litologia Umana*, 1819, *Arch. Gen. de Med.*, p. 444.

§ Also J. Wood, Lond. Med. and Ph. Journ., vol. lvii. p. 29.

|| Smith, Med. Chir. Trans., vol. xi. p. 13.

the size and figure of a large almond; when sawn through, it did not appear to consist of concentric layers, but exhibited irregular waved lines of various shades of brown, resembling very closely the section of a compact mulberry calculus. It was so extremely hard as to require a lapidary's wheel to divide it, and the cut surface readily acquired a fine polish. (Vide Plate XII. figs. 4–6.)

The calculi that were passed by the urethra are about the size of peas, of a rounded figure with flattened surfaces. They present a compact lamellar structure, and their external surface is of a light brown colour, fig. 5. These calculi were examined by Dr. W. H. Gilby and by Dr. Marcet, and found to be composed of carbonate of lime without any phosphate of lime*.

Carbonate of lime forms the most common variety of urinary concretions from the lower animals, especially of those from the herbivorous class; it is generally accompanied by carbonate of magnesia, and it is probable that in these animals it is secreted under precisely analogous circumstances to those, which in man, and in some carnivorous animals, would give rise to the deposition of the earthy phosphates.

The composition of the carbonate of lime calculus is readily shown by its effervescing with dilute muriatic acid. The solution, if not too acid, gives a white precipitate of oxalate of lime upon the addition of oxalate of ammonia, and carbonate of lime is thrown down upon the addition of any alkaline carbonate. If phosphate of lime be also present, the muriatic solution, on being neutralized with ammonia, deposits that salt in the form of a flocculent semi-gelatinous precipitate.

When heated before the blowpipe, its carbonic acid is driven off, and pure lime remains, which, when moistened with water, gives out heat, and renders turmeric paper brown.

I. *Carbonate of Lime.*

Of this species of calculus the Museum possesses no specimen.

* From the appearance of these calculi it is not improbable that they were formed in the prostate gland, or in some cyst about the neck of the bladder.

APPENDIX.

D 3. The fourth part of a large cystic oxide calculus, which, when entire, weighed 754 grains. This calculus was taken, by the lateral operation, from the bladder of Miles Sampsford, aged sixty-one, a patient in the London Hospital. The following particulars of the case were communicated by J. Luke, Esq.

The patient was a maltster's labourer, of temperate habits, and the father of a large family. He had suffered from irritation about the urinary passages for twenty years, which was supposed to arise from stricture of the urethra. About fifteen years ago he passed a calculus by the urethra, and subsequently several others, at intervals of two or three years. His urine was usually turbid, and sometimes deposited a sediment; occasionally it was clear and transparent. He had also experienced at times severe pains in the loins, and a sense of weight and oppression at the pit of the stomach after meals, attended by headache, but his appetite was usually good. His bowels were generally constipated, requiring the frequent use of purgatives. The whole of his symptoms were usually mitigated by the use of the balsam of copaiva, to which he has frequently had recourse. When admitted into the Hospital he was found to be suffering from the ordinary symptoms of stone in the bladder, although not to any great extent, as he was able to walk with freedom, and even leap from the ground without inconvenience. On sounding him, the calculus was readily felt. His urine was acid, and continued so throughout, although alkalies were freely administered.

The operation was performed by Mr. Luke in the ordinary manner the neck of the bladder being divided with a double-edged gorget. The calculus was readily seized by the forceps, but it could not be withdrawn from the bladder, even after the incision had been enlarged. On bringing the calculus to the opening in the bladder, and retaining it in that situation while the fore-finger was introduced into the bladder, it was found

that adhesions apparently existed between the calculus and the lining membrane of the bladder; these being gradually separated by the fore-finger, the calculus was set free, and came readily through the wound. There was considerable loss of blood during the operation, and the patient was removed in an exhausted state.

He died on the sixth day after the operation. The urine which came through the catheter that had been previously placed in the wound was found to contain cystic oxide in solution.

Examination after death.—The right kidney was somewhat enlarged, and its convex margin presented a series of transparent cysts containing a serous fluid. The cysts varied in size, the largest containing about an ounce of fluid.

The left kidney was flabby and congested with venous blood; it contained numerous white spots, which were solid, and apparently consisted of fibrine. The ureters were healthy.

The peritoneum investing the bladder was lustreless and covered by a thin layer of coagulable lymph. Blood had been effused into the cellular tissue beneath the peritoneum covering the right side of the sacrum. The bladder was contracted, its mucous membrane rugous, and in many places injected with blood. Immediately behind the prostate gland, the bladder was sacculated, forming a pouch in which the calculus had been lodged; the mucous membrane was at this part villous and rugged. The surface of the wound was in a sloughing state; the prostate gland had been freely divided, particularly at its posterior part, but infiltration of urine had not taken place. *Presented by J. Luke, Esq.*, 1843.

According to the analysis of Mr. Francis, 100 parts of this calculus consisted of

Cystic oxide	92·46
Red colouring matter mixed with portions of mucous membrane	5·09
Phosphate of lime, with a trace of phosphate of magnesia and ammonia	1·87
Loss	0·58
	100·00

The following Table exhibits the elementary composition of cystic oxide, as determined by recent experiments made by Messrs. Taylor and Francis on a portion of the above calculus, both in its impure state, and when separated from the other ingredients by solution in ammonia, and precipitation by acetic acid. They are

contrasted with the results previously obtained by Dr. Prout and M. Thaulow. The analysis of Dr. Prout having been made previous to the discovery of sulphur in cystic oxide, the quantity of that element was necessarily added to that of the oxygen, which in the analysis of organic substances is always estimated by the loss.

	The pure cystic oxide.			The impure calculus.		
	Prout.	Taylor.	Francis.	Thaulow.	Taylor.	Francis.
Carbon	30·49	30·79	29·61	30·01	30·51	
Hydrogen	5·10	5·78	6·03	5·10	5·62	
Nitrogen	11·85	10·99	11·48	11·00	11·55	
Oxygen	52·56	28·86	28·87	28·38	26·79	
Sulphur	0·00	23·58	24·01	25·51	25·53	25·81
	100·00	100·00*	100·00	100·00	100·00	

The above analyses have been calculated on the supposition that the equivalent of carbon is 6·12, that of nitrogen 14·19, and of sulphur 16·12. This has been done that the results may be more easily compared with the theoretical analysis of Thaulow given at page 96, and is not to be regarded as expressing any opinion as to the accuracy of those numbers.

The cystic oxide calculus presented by the Governors of St. Bartholomew's Hospital, described at page 98, was found to contain 22·891 per cent. of sulphur.

H 49. Several small calculi consisting of the *fusible* compound mixed with thin alternate layers of urate of ammonia, which are most abundant at the centre of each calculus: the urate of ammonia does not however constitute a distinct nucleus.

Presented by J. P. Vincent, Esq., with the following history, 1843:

"Frederick Rule, aged 23 years, by occupation a boot-maker, and who has generally had good health, was admitted into St. Bartholomew's Hospital under my care, Feb. 20, 1843, stating that he was suffering from incontinence of urine. On examining him, I found that to stop the constant flow of the urine, he was wearing a brass yoke; and that there was a tumour of the size of a goose-egg in the perineal space just behind the scrotum. On handling this tumour, it gave the sensation of a

* From another analysis, 30·80 carbon and 5·68 hydrogen were obtained.

collection of stones in a bag. The yoke was applied just behind the glans. On examining the urethra I found that a very narrow stricture existed about two inches from the orifice, below the usual situation in which the yoke was worn. Only the finest catgut could be passed through this stricture, and this came in contact with stones.

"The patient gave the following account:—About ten years ago he was kicked by a horse, when the parts about the pubis and the body of the penis were severely bruised; leeches, &c. were applied, and he was unable to void his urine for forty-eight hours; when it began to flow, it was preceded by a coagulum of the figure of the urethra. About three weeks after this he had difficulty in making water, and afterwards it only dribbled away when the bladder was much distended. This incontinence of urine continued; and he was taken to Sir A. Cooper about twelve months after the accident from the horse, who recommended the yoke, which he has continued to wear up to this time. Six years ago he had bleeding from the urethra for several days, and he then perceived a swelling in the situation of the present tumour. This enlargement gradually increased to its present size; the incontinence continues, and he has now pain in the tumour when he is in exercise, &c.—Feb. 25. I made an incision into the most prominent part of the tumour, and gave exit to 146 calculi of various figures and sizes, the largest being about the size of a horse-bean. After the pouch had been emptied there were several in that part of the urethra next the bladder, which were removed, and two of the number came away the next day. The cyst consisted of a dense and tough membrane, like parchment. It communicated with the urethra its whole length and graduated into it, so as to offer no abrupt nor partial connection with it, and appearing to me to be formed by its dilatation. After the operation the patient retained his urine, passing it voluntarily through the wound."

PLATE I.

Fig. 1. Represents a section of the ordinary uric acid calculus, when it has attained a large size. A 108, p. 17.

Fig. 2. Represents a section of a variety of the uric acid calculus; its texture being much less compact, and not regularly laminated; the structure of this calculus is merely a modification of that represented in Plate II. fig. 1. Its colour is also remarkable. A 122, p. 20.

Fig. 3. Exhibits the polished, tuberculated, or granular exterior which uric acid concretions sometimes present. A 110, p. 17.

Fig 4. Represents the section of a small uric acid calculus, exhibiting a radiated as well as a lamellar structure; calculi of this description sometimes separate spontaneously while in the bladder into angular portions, similar to those represented in figs. 6, 7, and 8. A 44, p. 12.

Fig. 5. Represents the exterior of a calculus taken from the same bladder as the preceding; its surface is bleached and water-worn, from having been subjected to the action of the urine for a considerable time.

Figs. 6, 7, and 8. Represent three small angular uric acid calculi which were passed by the urethra; from the structure of these calculi it is probable that they formed portions of larger calculi which broke up spontaneously in the bladder. A 29, p. 11.

Fig. 9. Exhibits the porous, earthy and non-laminated structure of some uric acid calculi; this calculus contains very little earthy matter, but a considerable quantity of urate of ammonia. A 174, p. 76.

Figs. 10, 11, and 12. Exhibit the regular cubic and tetrahedric figure acquired by uric acid calculi when several are present together in the bladder, and have but a limited space to move in. A 107, p. 17.

Fig. 13. Represents the section of an impure uric acid calculus; the nucleus consists of minute crystals of uric acid. A 173, p. 75.

Plate 1.

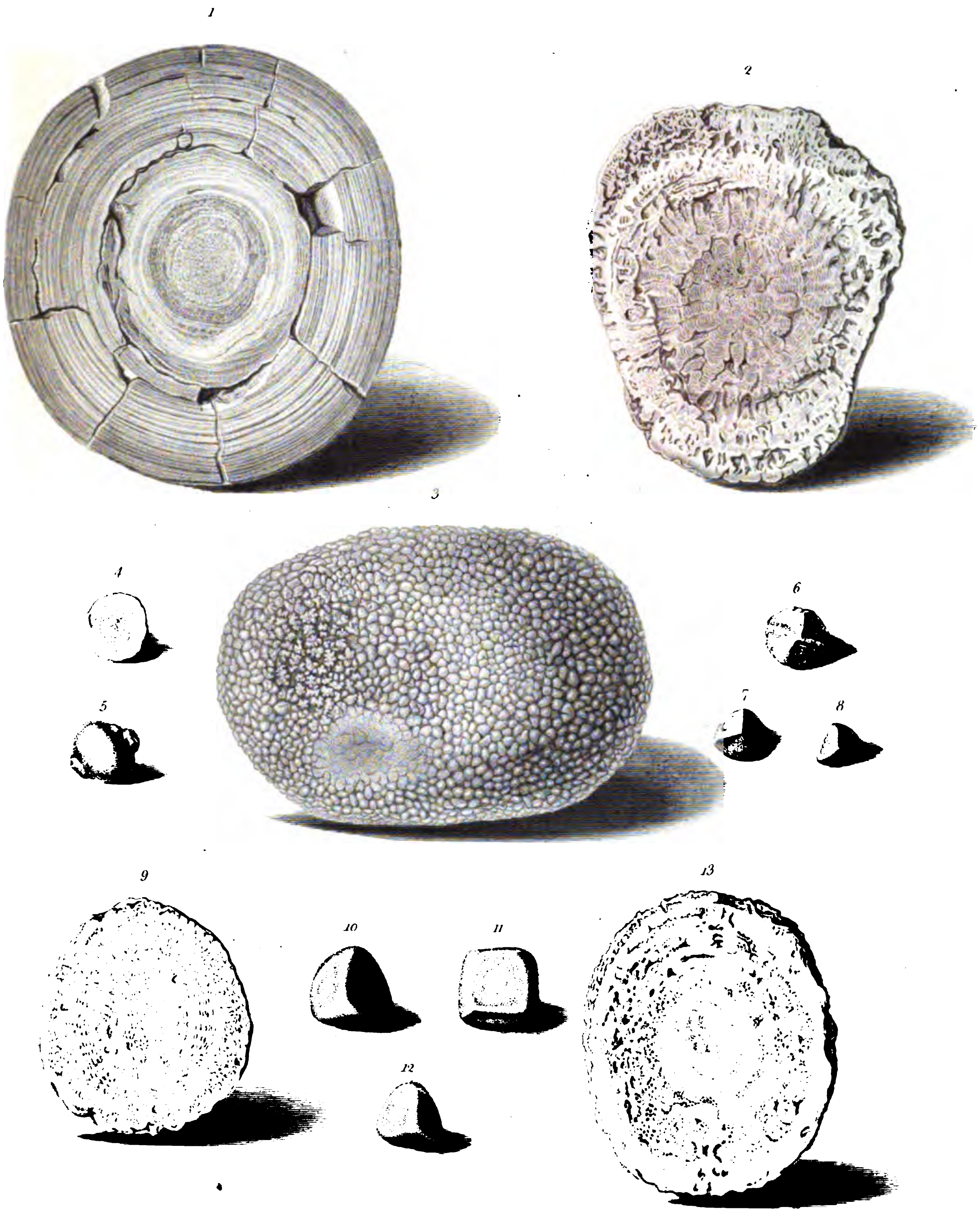


PLATE II.

Fig. 1. Represents the variety of the uric acid calculus which does not possess a lamellar structure, but consists for the most part of coarse granules, or semi-crystalline grains disposed in a radiating manner around the centre. A 64, p. 14.

Figs. 2, 3, 4, 5. Are representations of the calculi described at A 171, p. 25. Fig. 3. represents one of the small calculi, and the section of another, that were passed by the urethra prior to the use of alkalies. They are characteristic specimens of the pisiform uric acid concretion, and exhibit the plane surfaces, which these calculi sometimes present. Figs. 2 and 4. Represent the irregular masses of calculous concretion taken from the bladder after death, and exhibit the alteration which has been produced in the uric acid deposit by the use of alkalies. In fig. 5. this deposit is seen to be surrounding a portion of one of the pisiform calculi. The usual appearance of these masses when broken, is shown on the left-hand side of fig. 2. (Vide p. 7.)

Fig. 6. Represents a section of an uric acid calculus, the exterior of which is coated by a thin layer (*a*) of dark-coloured oxalate of lime. This deposit, although very thin, gives to the calculus the external appearance of a *mulberry* concretion. A b 1, p. 34.

Fig. 7. Represents the abrupt transition from the uric acid to the phosphatic diathesis; the fusible compound not being, in this case, preceded by the deposit of urate of ammonia. A c 3, p. 36.

Fig. 8. Represents a section of a small impure uric acid calculus surrounded by compact phosphate of lime. A c 1, p. 36.

Fig. 9. Represents a small uric acid calculus, which had probably been formed in one of the ureters. It was voided with the urine by Sir Joseph Banks, some days after having been overturned in his carriage. A 5, p. 9.

Fig. 10. Represents a section of a uric acid calculus from the kidney. A 123, p. 20.

Fig. 11. Is an external view of the same.

Fig. 12. Exhibits the crystalline centre and laminated exterior of a very characteristic specimen of the *pisiform* uric acid concretion. A 194, p. 29.

Plate. 2

From Nature on Zinc by Lens Aldous.

Day & Haghe Lithrs to the Queen

PLATE III.

Fig. 1. Represents a section of a large uric acid calculus, consisting of three distinct calculi united by a deposit of the earthy phosphates.

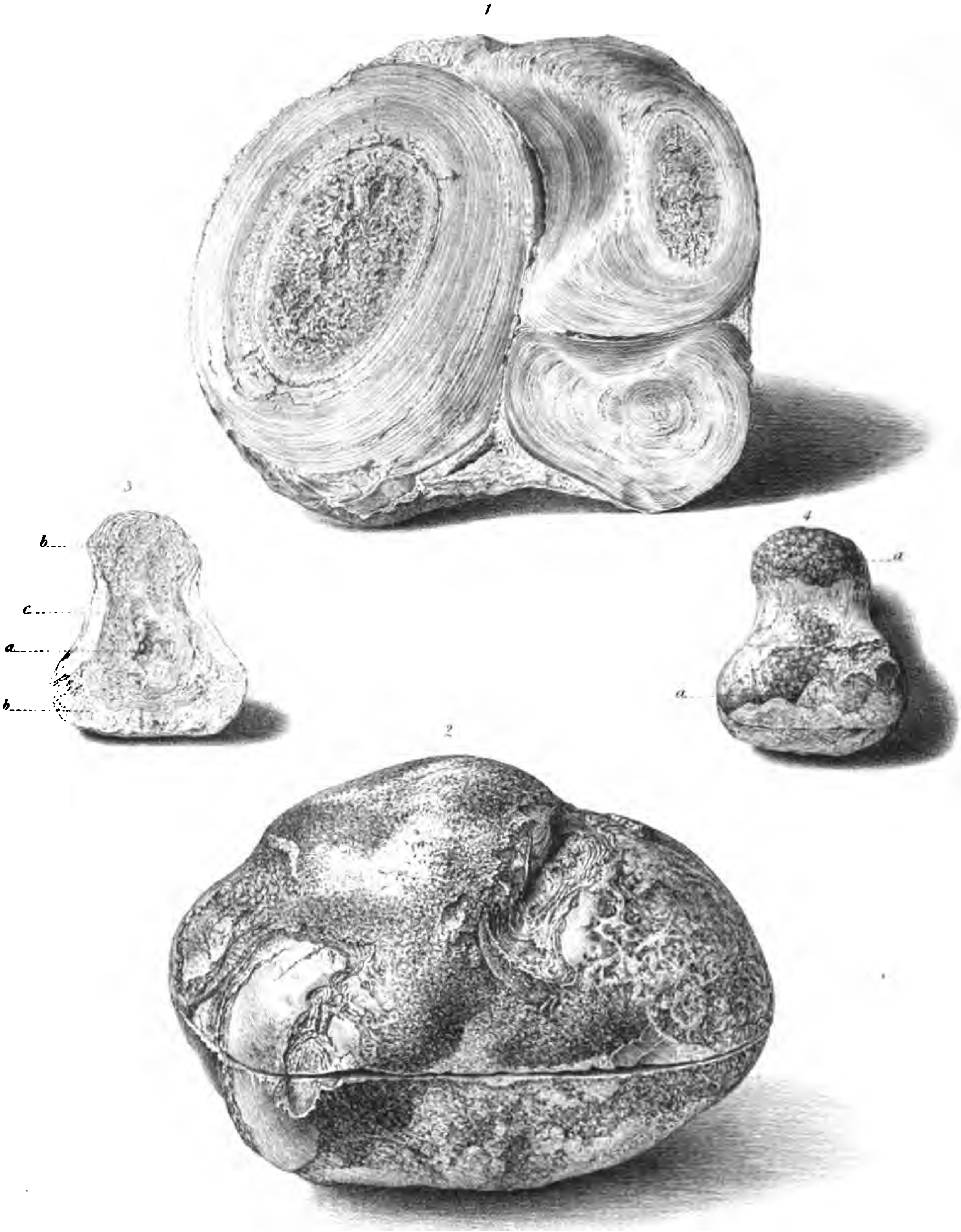
Fig. 2. Is an external view of the same, and shows the direction in which the calculus has been divided. A c 7, p. 37.

Fig. 3. Represents a section of a singular, but not very uncommon form of calculus: (*a*), the centre, consists of uric acid; (*b*, *b*), of a mixture of urate of ammonia and uric acid; (*c*), a layer of phosphate of lime.

Fig. 4. Represents the exterior of the same calculus. (*a*, *a*). Are partial deposits of oxalate of lime. A k 1, p. 44.

A calculus having a similar form is represented in Plate XII. fig. 12.

Plate 3.



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Day & Haghe Lith[rs] to the Queen

PLATE IV.

Fig. 1. Represents the external surface of a uric acid calculus, which has apparently undergone partial solution from the use of alkaline medicines. The exterior is porous, and as it were, worm-eaten, and is covered by a thin crust of urate of soda.

Fig. 2. Represents a section of the same calculus. The process at the upper part of the drawing has probably been produced by the adjoining parts having been dissolved. A 168, p. 24.

Fig. 3. Represents the exterior of the calculus taken after death from the bladder of Mr. Hay, who had taken alkaline medicines in enormous quantities for several years. The light brown layers, which, at one time, invested the whole of the calculus, undoubtedly owe their peculiar texture and appearance to the influence of alkalies: these layers are exceedingly brittle, and consist of impure urate of ammonia. A 184, p. 27.

Fig. 4. Represents the section of a cystic oxide calculus, showing its confusedly crystalline structure.

Fig. 5. Represents the external surface of the same, the projecting summits of the crystals giving to it a slightly tubercular appearance. D 1, p. 98.

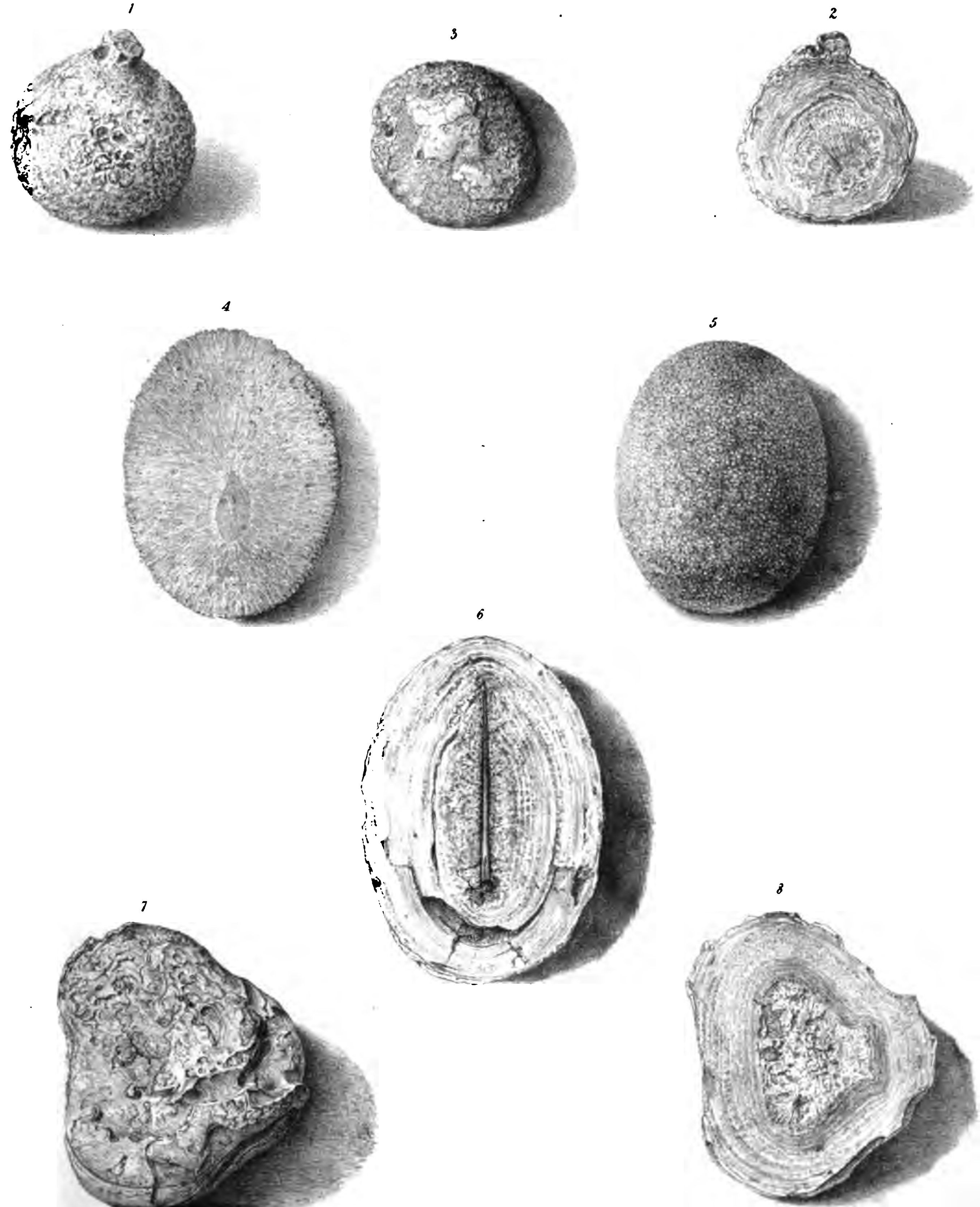
Fig. 6. Represents the section of a very remarkable calculus. It consists of pale-coloured uric acid mixed with urate of ammonia, deposited upon a slender piece of steel, which appears to be a portion of a stilet. From the manner in which the layers of this calculus surround the nucleus, there is no reason to suppose that the piece of steel has been introduced within the calculus, although the deposit of uric acid or any other substance, save the earthy phosphates upon foreign bodies in the bladder, is a very unusual occurrence. A 126, p. 20.

Fig. 7. Represents the exterior of a calculus similar in appearance and composition to that of fig. 1. It exhibits, however, in a still more marked manner, the effects of a solvent action having been exerted on its surface, and it is likewise incrusted by a thin coat of urate of soda.

Fig. 8. Is a section of the same, showing that the concentric layers of the calculus terminate abruptly at the points corresponding with the depressions on the surface; an effect which could only have been produced by the removal of those parts. The thickness of the outer coat of urate of soda is also seen. A 169, p. 24*.

* Since these drawings were made, a calculus has been received from the collection of Mr. Liston, which illustrates in a very satisfactory manner the fact of calculi undergoing partial solution, while in the bladder. This calculus is figured in Plate XII. figs. 16, 17, and shows that the destruction of its outer layers could have taken place only in the bladder, a circumstance which is merely conjectural in the above specimens.

Plate 4.



Nature on Zinc by Lens Aldous.

PLATE V.

Fig. 1. Represents the transition from urate of ammonia to oxalate of lime, and from that to uric acid. The nucleus does not consist of pure urate of ammonia, but is mixed with uric acid. B g, p. 65.

Fig. 2. Represents the exterior of a uric acid calculus, which is thinly coated by urate of ammonia. A a 1, p. 32.

Fig. 3. Is the exterior of a similar calculus.

Fig. 4. Represents the section of the same.

Fig. 5. Represents the section of a very beautiful oxalate of lime calculus having a small nucleus of impure urate of ammonia. The white layers consist principally of phosphate of lime. B b 4, p. 51.

Fig. 6 (*a*). Represents a gray layer of urate of ammonia occurring between the deposits (*b* and *c*) of uric acid. A d 1, p. 40.

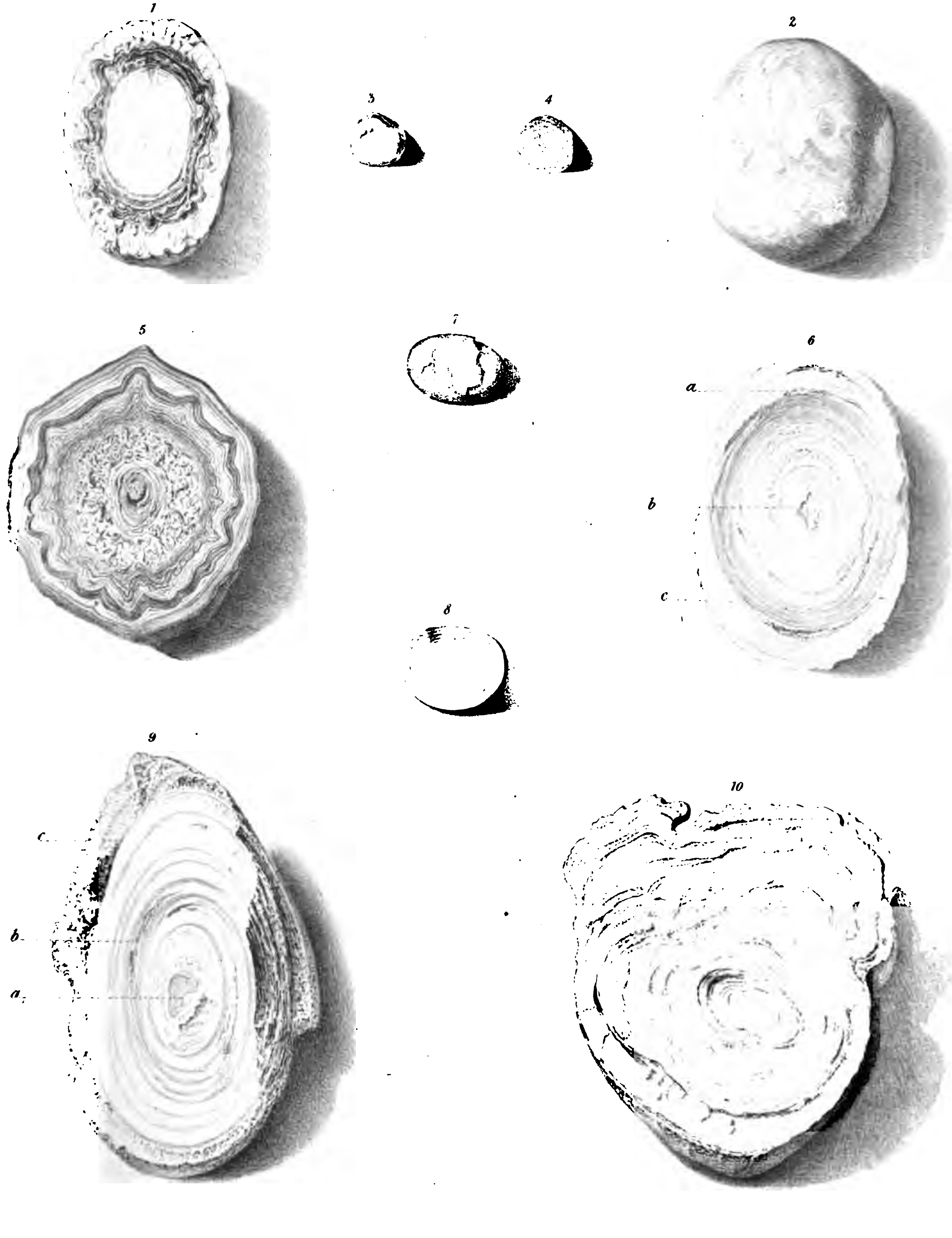
Fig. 7. Represents the ordinary appearance of the exterior of a urate of ammonia calculus. B 1, p. 47.

Fig. 8. Represents a section of a urate of ammonia calculus. B 8, p. 47.

Fig. 9. Exhibits the transition from the uric acid to the confirmed phosphatic diathesis. (*a*.) A small irregular nucleus of uric acid, surrounded by a gray layer of urate of ammonia. (*b*.) Urate of ammonia, and the fusible calculus in alternate layers. (*c*.) Crystalline phosphate of magnesia and ammonia. A f 9, p. 42.

Fig. 10. Represents a section of a large renal calculus, consisting of uric acid deposited upon a nucleus of urate of ammonia. B a 1, p. 48.

Plate. 5.



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Day & Haghe Lith^{rs} to the Queen

PLATE VI.

Fig. 1. Exhibits the section of a calculus, consisting of urate of ammonia surrounded by the phosphates; the marbled appearance which this specimen presents is not common, and is produced by the intermixture of urate of ammonia, and by the difference in the relative proportion of the earthy salts, the whiter parts containing more phosphate of lime. B c 1, p. 54.

Fig. 2. Exhibits the section of a very singular calculus; the nucleus consists of urate of ammonia, and is placed close to one extremity; it was probably lodged in one of the ureters; while in this situation, the alternating layers of the mixed phosphates and urate of ammonia, included within the dark line, were deposited upon it, and the elongated calculus thus formed having escaped into the bladder, became coated by the mixed phosphates. B c 62, p. 61.

Fig. 3. Represents one half of a calculus, which was perforated by Mr. Costello; calculous matter has been subsequently deposited upon its exterior, completely closing the aperture, but leaving the cavity merely lined with a thin crust of the phosphates. B g 3, p. 65.

Fig. 4. Represents the section of a large calculus consisting principally of uric acid; this figure shows the manner in which calculi are sometimes capped by an accumulation of calculous matter, giving rise to the appearance of being constricted in their short diameter. B g 2, p. 65.

Fig. 5. Exhibits the transition from the urate of ammonia to the oxalate of lime diathesis, which in this instance is abrupt and well-defined; the exterior is thinly coated by a white layer consisting of the oxalate and phosphate of lime. B i 12, p. 68.

Fig. 6. Represents the section of a calculus, the nucleus of which consists of urate of ammonia with oxalate of lime; around this, is white oxalate of lime mixed with some phosphate of lime; the whole is coated by pure oxalate of lime, and upon this is a partial deposit of uric acid. B k 10, p. 72.

Fig. 7. Is an exterior view of the same calculus.

Plate 6.

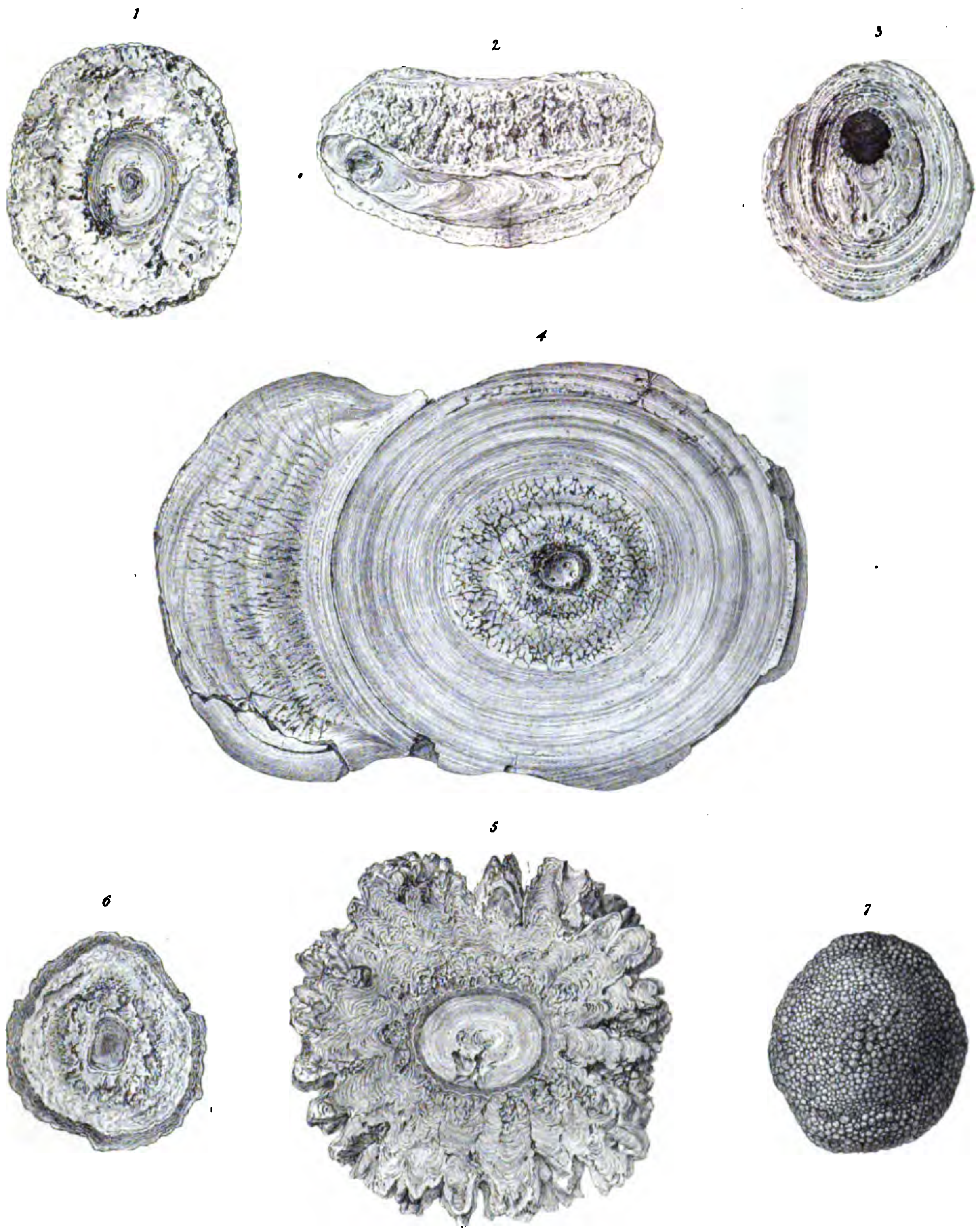

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PLATE VII.

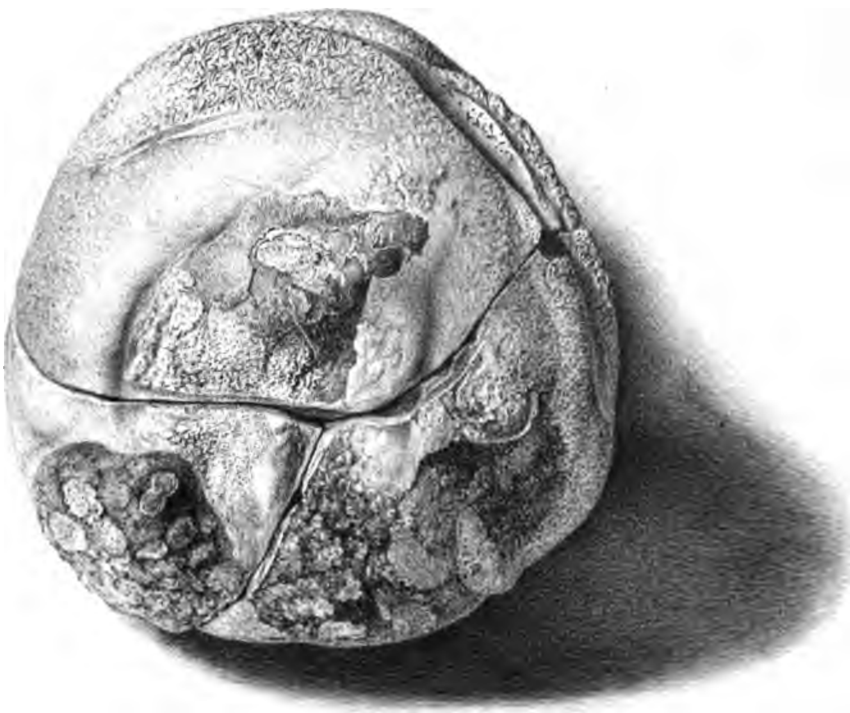
Fig. 1. Represents the exterior of a large calculus, consisting of three separate calculi in close contact with each other, but not united.

Figs. 2 and 3. Is the same calculus separated into two parts, showing its articulating surfaces, and the separate nuclei; in order to expose the latter, a small portion has been scraped away from that on the right-hand. The nuclei consist of urate of ammonia mixed with the earthy phosphates, while the bulk of the calculus is composed of nearly pure phosphate of magnesia and ammonia; from the upper part of these two figures, crystallized fragments of the triple phosphate have been accidentally detached. *a, a, a.* Represents the groove formed by the current of urine, which is generally present in calculi that have filled the entire cavity of the bladder.

In calculi of this description, the larger portion is generally placed immediately behind the prostate gland, occupying the trigonal space, while the other two are placed above, and on each side of it. B c 9, p. 55.

Plate. 7.

1



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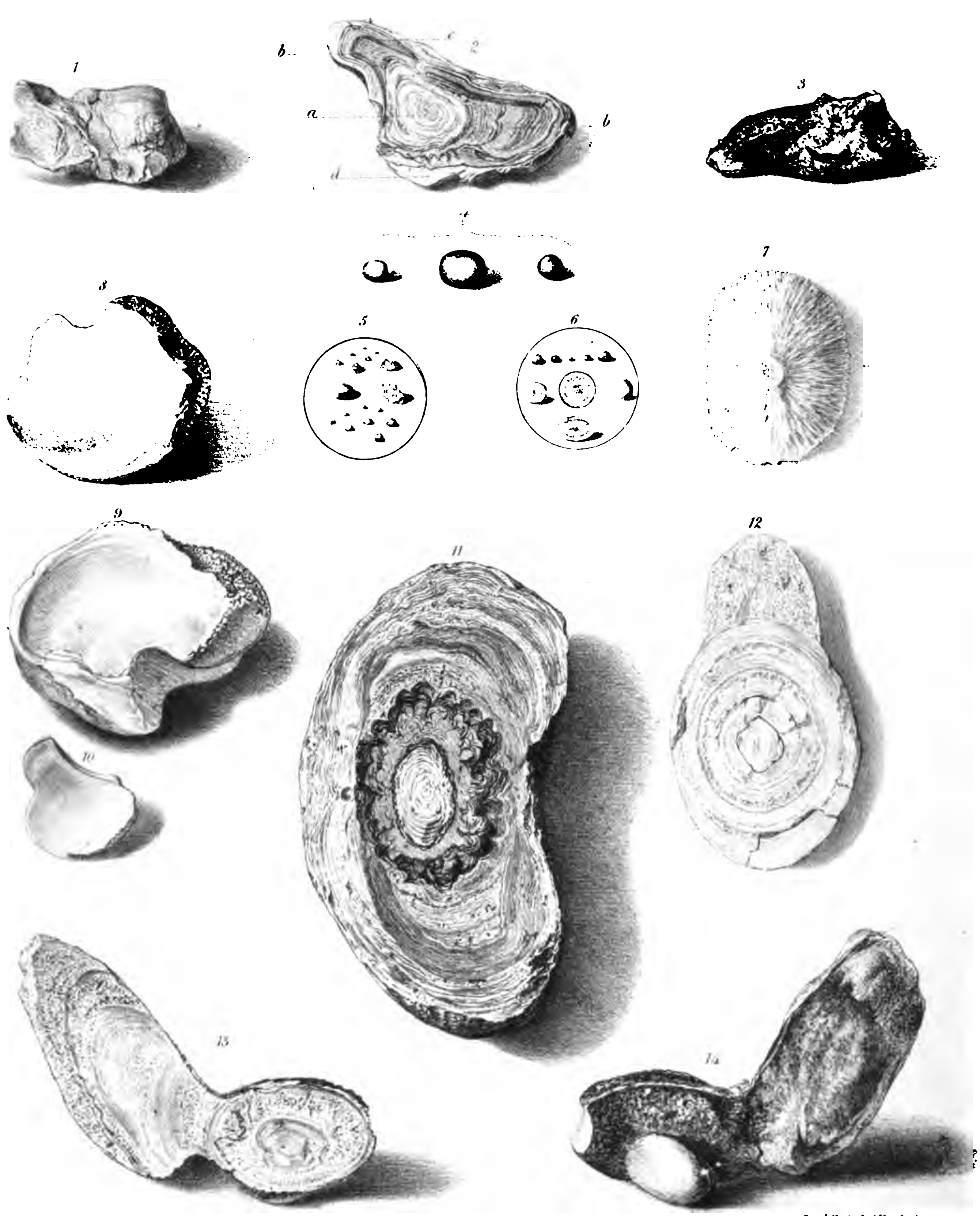


From Nature on Stone by [illegible]

Day & Haghe Lith^rs to the Queen

PLATE VIII.

Figs. 1, 2, 3, and 4. Represent some concretions taken from the pelvis of a kidney preserved in the Museum.

Fig. 1. Consists principally of phosphate of lime, but has not been divided. Fig. 2, (*a*). The nucleus, consisting of urate of ammonia. (*b, b.*) Layers of pure uric acid which do not entirely surround the nucleus. (*c.*) A layer of oxalate of lime mixed with urate of ammonia. (*d.*) The earthy phosphates. Fig. 3. Oxalate of lime partially coated by the phosphates. Fig. 4. Three small calculi consisting of oxalate of lime mixed with urate of ammonia, and having a nucleus of impure uric acid. B k 13, p. 73.

Fig. 5. Represents the ordinary appearance of the small phosphate of lime calculi found in the cells of the prostate gland.

Fig. 6. Represents the small oxalate of lime concretions described at p. 74 and C 29, p. 82; the middle and lower figures have been magnified, in order to show more distinctly the crystallized centre, and laminated exterior of these calculi. The others are of their natural size and appearance.

Fig. 7. Represents a portion of a triple phosphate calculus, deposited upon a small nucleus of the fusible compound. G 3, p. 111.

Figs. 8, 9, and 10. Represent concretions taken from a cyst in the prostate gland. The anterior surfaces of figs. 8 and 9. were closely in contact with each other, and the deep notch on the upper part of fig. 8. formed a channel for the escape of the urine; it corresponds with the groove on the lower and right-hand side of fig. 9. They all consist of the earthy phosphates. H 13, p. 121.

Fig. 11. The nucleus of this calculus consists of urate of ammonia mixed with oxalate of lime; it is followed, first, by oxalate of lime; secondly, by uric acid; and lastly, by alternate layers of urate of ammonia and the earthy phosphates. The surface of the oxalate of lime deposit appears to have been covered with coagulated blood, as the subsequent deposit of uric acid is not in contact with every part of it. B k 1, p. 71.

Fig. 12. Shows the singular manner in which calculi are sometimes capped with a deposit of the triple phosphate. The nucleus consists of urate of

ammonia; this is surrounded, first, by uric acid, and lastly, by urate of ammonia, with thin intervening layers of the phosphates. B k 12, p. 73.

Fig. 13. Represents a section of a remarkable, but not very uncommon form of calculus. The nucleus is composed of urate of ammonia surrounded by a well-defined deposit of uric acid; upon this the earthy phosphates form a thin coat. The process on the left of the figure consists, at that portion nearest to the calculus, of the earthy phosphates, with thin intervening layers of uric acid; its extremity consists principally of the triple phosphate. B f 2, p. 64.

Fig. 14. Is an exterior view of the same calculus in the position which it probably occupied in the bladder. The oval part of the calculus being lodged in the prostate gland, while the elongated process extended into the cavity of the bladder. The small white mass attached to the oval portion of the calculus, was most probably formed in a dilated cell, or abscess of the prostate; it consists of the earthy phosphates.

PLATE IX.

Fig. 1. Represents the internal appearance of the mulberry calculus. C 7, p. 79.

Fig. 2. Is an external view of the same calculus.

Fig. 3. Represents an oxalate of lime calculus bearing some resemblance to the fruit of the mulberry, from which this variety has derived its name. C 5, p. 79.

Fig. 4. Represents a section of the white crystalline variety of the oxalate of lime calculus, the exterior of which is seen in fig. 5. to be studded with octohedral crystals. C 1, p. 78.

Fig. 6. Represents a section of a white oxalate of lime calculus, supposed to be from the kidney. The structure of this calculus is exceedingly beautiful; it consists of a number of small circles with fine lines radiating from their centre. The tuberculated character of the mulberry calculus is probably derived from this tendency of oxalate of lime to crystallize in small masses radiating from the centre. C 19, p. 81.

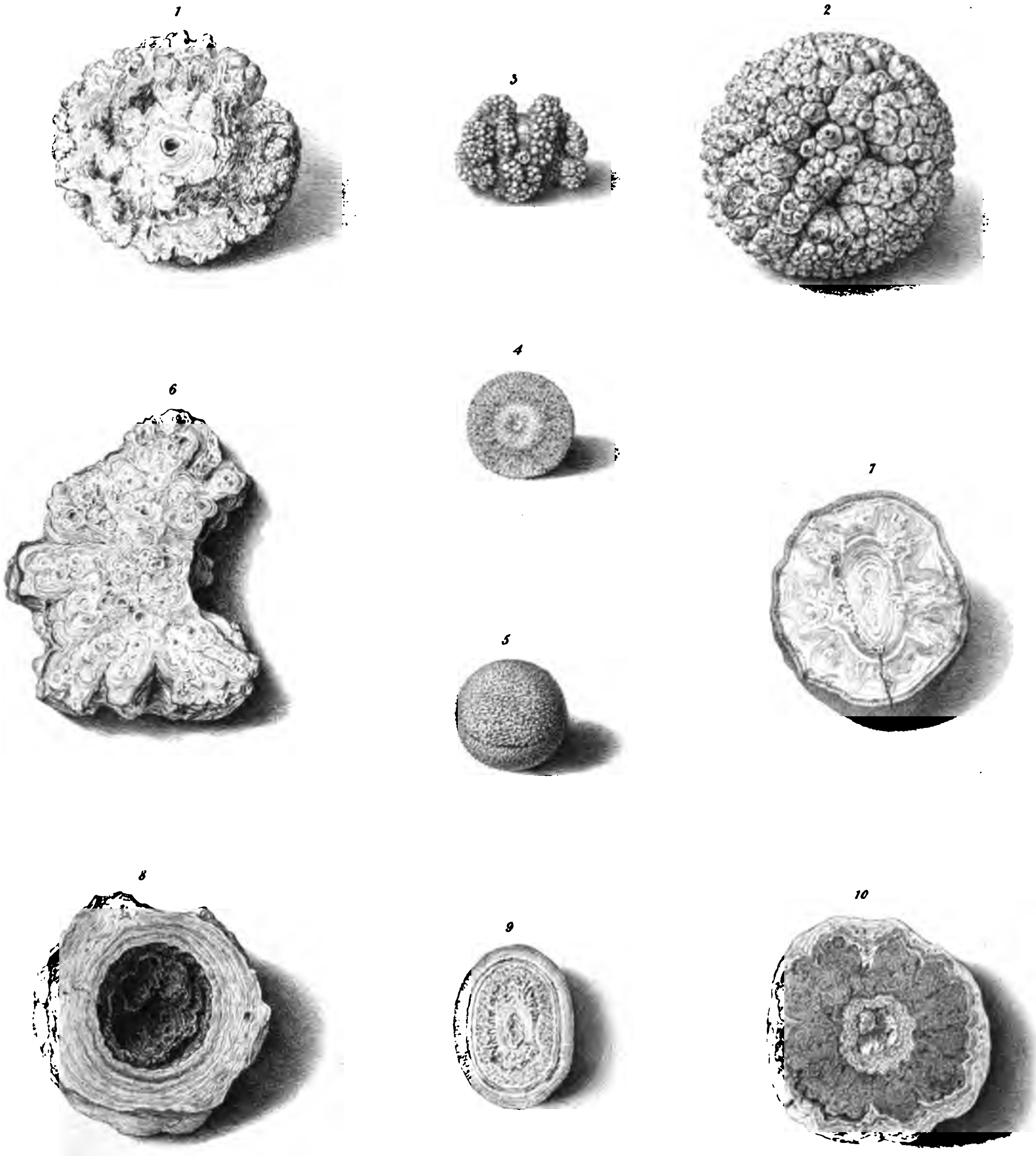
Fig. 7. A section of a calculus, in which the phosphatic diathesis has been followed by that of oxalate of lime; the inner and outer part of this calculus consists of nearly pure oxalate of lime, while the white portion is composed of the fusible calculus. H b 1, p. 131.

Fig. 8. Represents the section of a calculus consisting of uric acid, deposited upon a hollow shell of dark-coloured oxalate of lime. The nucleus of this calculus appears to have been a clot of blood. C a 7, p. 85.

Fig. 9. Oxalate of lime coated by crystallized phosphate of lime, showing the radiating fibres of the latter. C c 1, p. 87.

Fig. 10. Is a section of a calculus showing the abrupt transition from the oxalic to the uric acid diathesis: it is remarkable, that uric acid, when deposited upon oxalate of lime, has generally the peculiar yellow colour here represented. C a 16, p. 86.

Plate 9



From Nature on Zinc by Lens Aldous.

Day & Haghe Lith^rs to the Queen

PLATE X.

Fig. 1. Represents the section of a singularly formed calculus, composed of irregular layers of the earthy phosphates mixed with urate of ammonia.

Fig. 2. Is an external view of the same. This calculus was lodged partly in the urethra, and partly in the bladder; the larger portion (*a*) occupying the prostatic and membranous portions of the urethra, and extending as far as the bulb, while the cylindrical coloured portion (*b*) projected into the cavity of the bladder. H 8, p. 120.

Fig. 3. Represents an unusual form of a vesical calculus.

Fig. 4. Represents a section of the same; the nucleus contains some urate of ammonia; the white portion surrounding this consists of the fusible calculus, and the exterior is principally composed of crystallized triple phosphate. H 12, p. 121.

Fig. 5. A section of a very remarkable renal calculus, composed of nearly pure phosphate of magnesia and ammonia. The part (*a*) consists of the triple phosphate confusedly crystallized, and was doubtless formed in the pelvis of the kidney; the rest of the calculus is compact and laminated. By the gradual increase of this calculus, progressive absorption of the substance of the kidney was produced, until the whole of the organ was replaced by a mass of calculous matter surrounded only by its fibrous tunic. G 1, p. 111.

Fig. 6. Is an external view of the same calculus

From Nature on Stone by J. Erxleben.

Day & Haghe Lith^rs to the Queen

PLATE XI.

Fig. 1. Represents a contorted bougie upon which the phosphates have begun to be deposited. This specimen was taken from the bladder of a man, and appears to have taken its present form while in the bladder. H a 6, p. 128.

Fig. 2. Represents a hat-pin, near the head of which a small mass of the mixed phosphates has been deposited. It was taken from the bladder of a woman. H a 7, p. 128.

Fig. 3. Represents a portion of a calculus, consisting of the mixed phosphates deposited upon a pea: for the history of the case vide H a 3, p. 128.

Fig. 4. Represents a large silver bodkin which was introduced into the bladder of a woman, and on the upper part of which the phosphates have concreted. H a 1, p. 128.

Figs. 5 and 6. Represent two halves of a calculus, consisting of the earthy phosphates deposited upon a mass of margarate and oleate of lime. This substance is represented in fig. 5. It is of a light yellow colour, and its irregularities correspond with the cavities represented in fig. 6; although, from its having shrunk considerably, it was quite loose in the centre of the calculus. For the probable origin of this calculus, vide H a 9, p. 129.

Fig. 7. Represents a section of a calculus, removed by dilating the urethra, from the bladder of a woman. It consists of the mixed phosphates, and has a piece of bone for its nucleus. H a 11, p. 129.

Fig. 8. The mixed phosphates deposited upon a piece of steel. It is singular that this nucleus does not correspond with the long axis of the calculus, although there is no reason to suppose its being a fabrication.

Fig. 9. Represents the section of a calculus similar in every respect to that delineated in fig. 5. H a 10, p. 129.

Plate II.

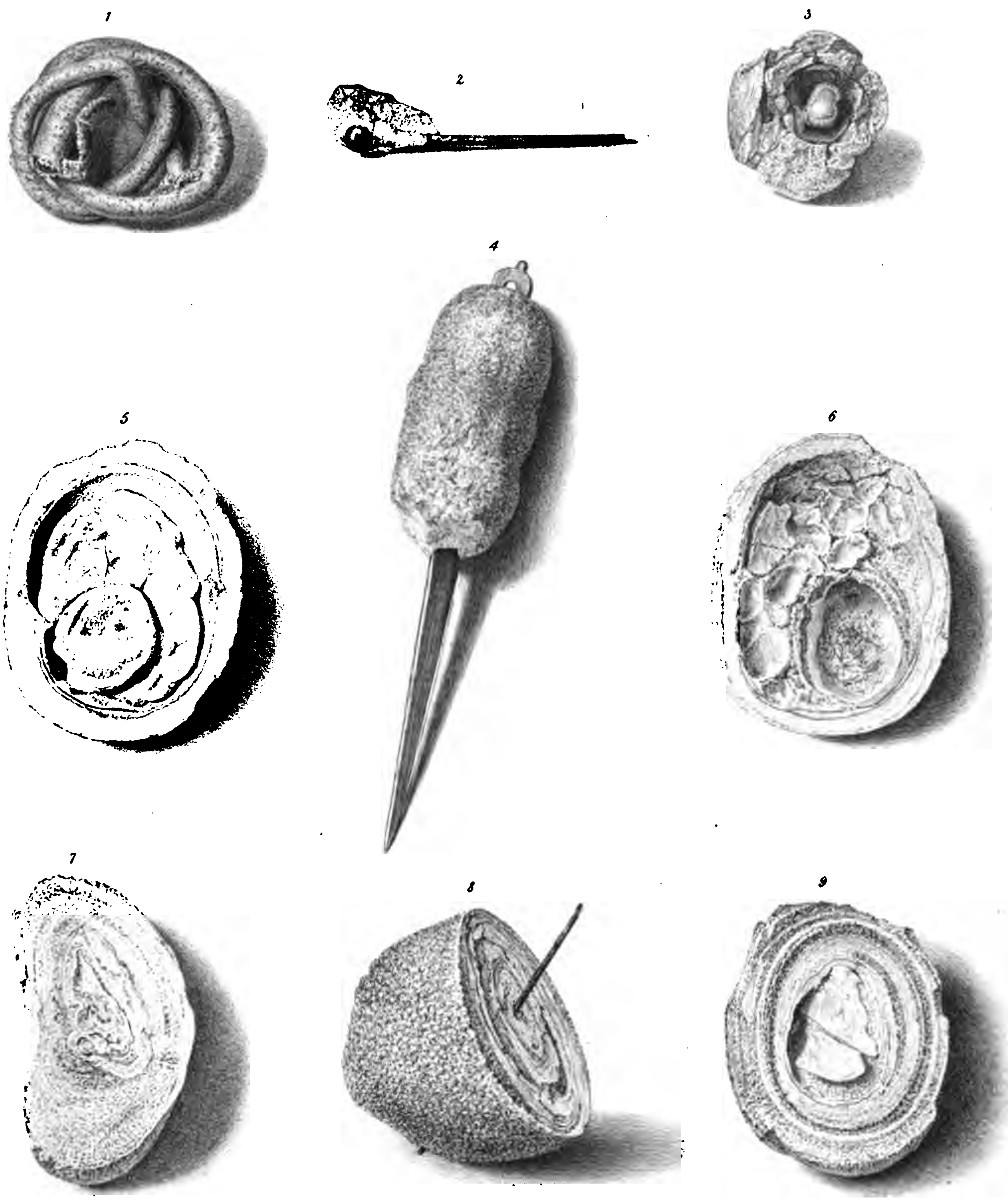


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Plate 12

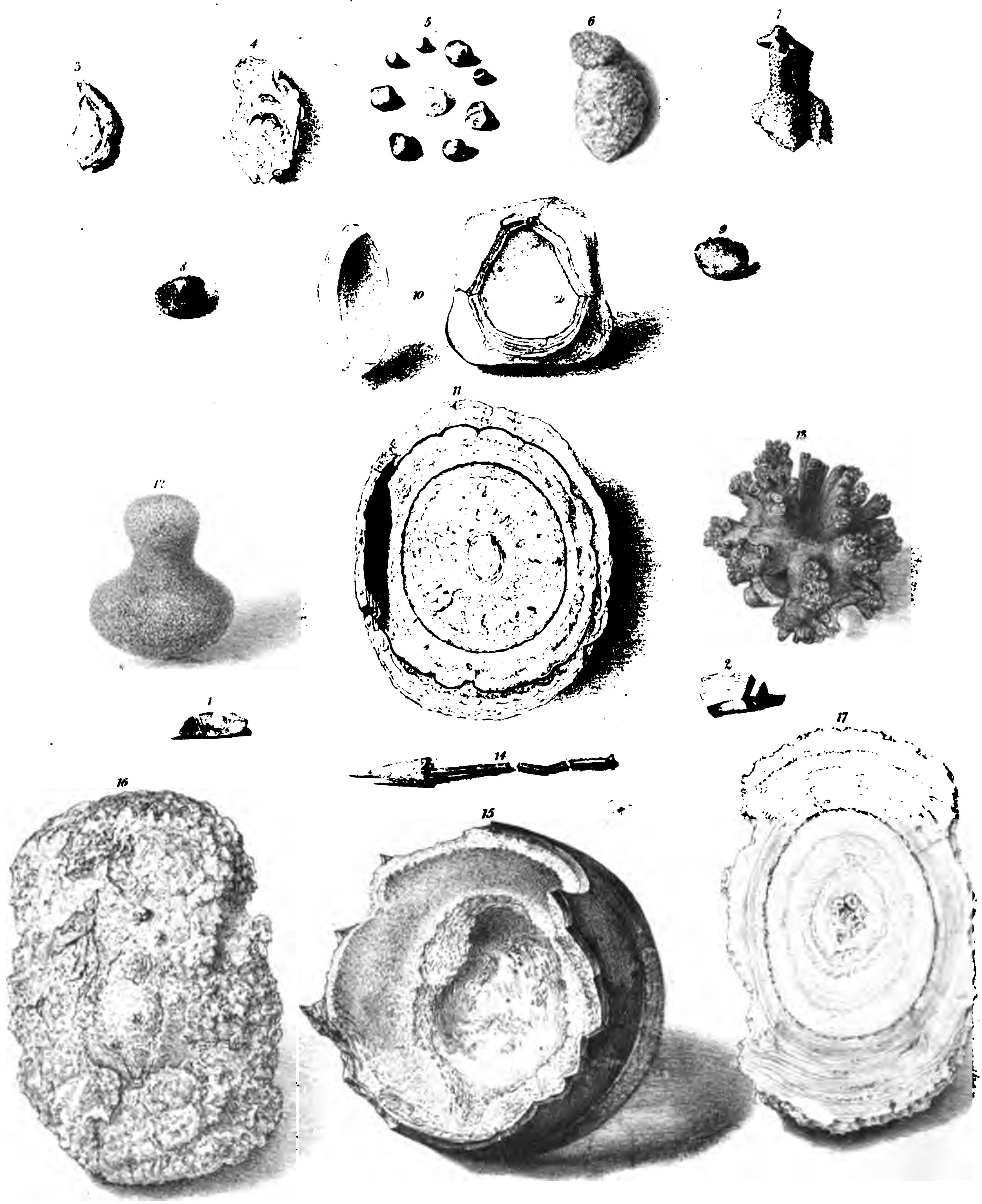

PLATE XII.

Fig. 1. Represents the external surface of a fragment of the xanthic or uric oxide calculus described by Liebig and Wöhler. E 1, p. 102*.

Fig. 2. Represents the internal structure of the same.

Figs. 3, 4, 5, 6, and 7. Are drawings of some carbonate of lime calculi: engraved by permission of Richard Smith, Esq., Bristol.

Figs. 8 and 9. Are two views of the small mulberry calculus, in which crystals of silica were discovered by the late Dr. Yelloly. Museum of the Norwich Hospital.

Fig. 10. Represents the central portion, and one of the fragments of a large uric acid calculus, which separated spontaneously in the bladder into numerous pieces. Museum of St. Bartholomew's Hospital.

Fig. 11. Represents the section of a calculus, which forms an exception to the *general* law of the phosphatic diathesis, not being succeeded by any other deposit. The white layer in this calculus consists of the earthy phosphates; it is surrounded, first, by a thin layer of very dark-coloured oxalate of lime, upon which has been deposited nearly pure uric acid. The centre of the calculus consists of urate of ammonia surrounded by oxalate of lime. Museum of St. Bartholomew's Hospital†.

Fig. 12. Represents an oxalate of lime calculus, the external surface of which is covered with octohedral crystals. From this circumstance, it is not probable that the calculus owes its peculiar figure to its having been embraced by any portion of the bladder. C 31, p. 83.

Fig. 13. Represents the exterior of an extremely rugged mulberry calculus. C 33, p. 84.

Fig. 14. Represents three portions of a pin, which were extracted from the bladder of a young man during the operation of Lithotrity. It had

* Poggendorff's *Ann.*, b. xli. s. 393.

† London Medical Gazette, April 1838, p. 193.

been entirely surrounded by the earthy phosphates, a portion of which still adheres towards its point. H a 14, p. 130.

Fig. 15. Represents the bottom of a glass tumbler, taken from the vagina. Its interior is lined by the earthy phosphates. H a 13, p. 129.

Fig. 16. Exhibits the external surface of a calculus which has undergone partial solution, while in the bladder.

Fig. 17. Represents a section of the same. In this drawing are shown the abrupt termination of the outer uric acid layers, together with the thickness of the layer of the fusible compound, which has been deposited over the whole of its exterior. C f 8, p. 92.

THE END.

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RED LION COURT, FLEET STREET.

For the Radcliffe Library, Oxford –
From the Council of the College
Edm. Belfour

A DESCRIPTIVE AND ILLUSTRATED CATALOGUE OF THE CALCULI AND OTHER ANIMAL CONCRETIONS CONTAINED IN THE MUSEUM OF THE ROYAL COLLEGE OF SURGEONS IN LONDON.

LONDON:
PRINTED BY RICHARD AND JOHN E. TAYLOR,
RED LION COURT, FLEET STREET.
1845.

CONTENTS.

ERRATA.

For partium, p. 145, third line from the bottom, *read* partum.
For Beliphaein, p. 163, *read* Biliphaein.

Division II.

CALCULI FROM THE URINARY ORGANS OF THE LOWER ANIMALS.

INTRODUCTION.

CALCULOUS concretions are much less frequently found in the urinary organs of the lower animals than in those of Man. The composition of these bodies in the inferior animals is also much simpler, both as regards the number of layers of which they consist, and the chemical nature of their constituents. They very rarely contain those complex organic principles which constitute the greater part of the concretions from the human subject, as uric acid, urate of ammonia, and oxalic acid, but are generally composed of inorganic compounds, as the earthy carbonates and phosphates. Even among the latter class of substances the carbonates are of much more frequent occurrence than the phosphates.

Another peculiarity belonging to calculi from the lower animals is to be found in the fact, that they almost invariably consist of the same substance throughout; they sometimes vary in structure and appearance, but scarcely, if ever, possess the *alternating* structure so frequently observed in human urinary concretions. The only approach to an alternating calculus in this collection is from the Hog, in which phosphate of magnesia and ammonia has been deposited upon a small nucleus of carbonate of lime.

Domestic animals, especially the Horse, the Dog and the Ox, appear to be most subject to calculous disease. It must not, however, be inferred from this

circumstance that the formation of a calculus is solely produced by confinement, or the habits consequent upon domestication, since calculi are found in the urinary organs of the Whale, Iguana, Sturgeon and other animals living in a state of nature. It is also to be remembered that it is chiefly among domestic animals that we have the opportunity of discovering these bodies.

The composition of urinary calculi from the different species of animals appears to depend principally upon the nature of the food of the animal, and to be wholly irrespective of the class or division in the animal kingdom to which it may belong. In the carnivorous and omnivorous tribes, as the Dog, Whale, Eagle, Iguana and Sturgeon, we find calculi consisting of uric acid and of earthy phosphates, while the concretions from purely graminivorous animals are composed almost entirely of the carbonates of lime and magnesia.

This difference in composition probably depends upon a corresponding difference in the chemical characters of the healthy urine of these animals. In the Carnivora the urine is almost always acid, while in the Graminivora, from the presence of alkaline carbonates, it has invariably an alkaline reaction*.

The following Table is designed to illustrate the preceding remarks. It has been formed only from calculi, the origin of which is well authenticated. The figures indicate the number of specimens in the Museum from each animal.

Uric acid and the urates	From the Ostrich 1, Iguana 2.
Oxalate of lime	„ Ox 2.
Phosphate of lime	„ Sturgeon 2.
Phosphate of magnesia and ammonia	„ Dog 3, Hog 1, Whale 1.
Mixed phosphates	„ Dog 2, Monkey 1.
Carbonate of lime, either pure or mixed with some carbonate of magnesia	„ Horse 8, Ass 1, Ox 10, Hog 4, Elephant 1, Rhinoceros 1, Tortoise 1.

Urinary calculi from the lower animals may be divided into the seven following classes or species:—1st, calculi consisting principally of uric acid, or of any

* Prof. Liebig has set forth some ingenious views as to the cause of the acidity and alkalinity of the urine, which it may be well to notice in this place. Assuming as an irrefutable fact, that the inorganic bases in the urine, such as potass, soda, lime, &c., have entered the organism through the medium of the elements, he has endeavoured to show that the acid or alkaline condition of the urine depends upon the nature of the inorganic constituents of the food of the animal, and is wholly uninfluenced by any difference in the processes of respiration, digestion or secretion. The ashes of all vegetable substances,

of its compounds, as the alkaline and earthy urates; 2nd, of oxalate of lime; 3rd, of cystic oxide; 4th, of phosphate of lime; 5th, of phosphate of magnesia and ammonia; 6th, of the fusible calculus, or the mixed phosphates; and lastly, of the carbonates of lime and magnesia.

Small and unimportant quantities of carbonate of magnesia, sulphate of lime, peroxide of iron, silica and alkaline salts, are frequently met with in the analysis of these concretions. They also contain a considerable quantity of animal matter, which is left undissolved in the form of thin membranous flakes, when the other constituents of the calculus are removed by the action of an acid or other solvent. The animal matter frequently retains the exact figure and size of the calculus in the same manner as the gelatine of bones.

The nature of the animal matter found in all species of calculi has never yet been satisfactorily determined. Some have regarded it as consisting of gelatine, others of albumen. Fourcroy believed that it was not always the same, but that it varied according to the nature of the calculus, being sometimes of an albuminous, sometimes of a gelatinous nature, and at others partaking of the characters of both*. Berzelius denies the possibility of determining its composition by chemical means†. In a great number of the calculi in this collection the animal matter has certainly been of an albuminous nature, nor could the existence of gelatine be satisfactorily detected. At the present time the almost universal opinion is, that the animal matter is an *accidental* constituent of the calculus, consisting chiefly of mucus, which has become entangled among the precipitating particles of the calculus, and has served to cement them mechanically into a solid mass.

If this view of the composition of the animal matter were correct, we should

with the exception of the seeds of the cereals and of leguminous plants, he states to be alkaline, owing to the presence of the carbonates of soda and potass, which either exist as such in the plant, or are derived from the decomposition of the vegetable acid with which the base was combined in the plant. Hence in graminivorous animals the urine cannot obtain an acid reaction, as the acids of the urine are supersaturated by the alkaline salts contained in the food. The ashes of muscular fibre, on the other hand, and also of the seeds of the cereals and leguminous plants, do not contain carbonated alkali, but abound in alkaline and earthy phosphates. According to Prof. Liebig, the acid character of the urine is produced by the reaction of uric, hippuric, and probably also of sulphuric acid upon these alkaline phosphates, by which part of the base of these salts is abstracted and an acidulous phosphate produced.

* *Système des Connaissances Chimiques*, tom. x. † *Lehrbuch der Chemie.*

expect to find it to consist of a mass of epithelial particles more or less closely matted together. Such is not, however, the case. In all species of urinary as well as intestinal concretions, the animal matter consists of a fine membranous tissue, which is uniformly diffused throughout the calculus, and varies slightly in appearance, according to the structure of the calculus. In calculi which have a laminated texture, it consists of concentric layers of a thin transparent structureless membrane, which presents a sharp and well-defined margin; sometimes the membrane is less homogeneous, and presents a granular appearance. In calculi which have a compact and crystalline texture, the animal matter does not admit of being separated into layers, but forms a continuous tissue. Small filaments, apparently possessing a tubular structure, are also sometimes to be observed: these filaments give off branches and occasionally ramify in every direction, so as to form a confused network; they vary in diameter from $\frac{1}{10,000}$ to $\frac{1}{30,000}$ of an inch*, but are not quite uniform, being sometimes irregularly dilated and occasionally presenting a moniliform appearance: they are apparently filled with a gelatinous or granular matter; in general they terminate abruptly, and occasionally have a small bulbous expansion at their extremities.

These filaments are most frequently found in intestinal concretions: they are apparently of a confervoid nature, and in urinary concretions it is most probable that they were formed after the calculus was taken from the body, and that they are of the nature of a vegetable mould. Portions of these filaments were, however, detected in some fragments of a phosphatic concretion which had been very recently taken from a patient, also in a urinary? calculus which had been preserved in spirit. In the phosphatic concretion just mentioned, numerous small globules were also observed by Mr. Quekett, which he supposed to be sporules. In the animal matter of urinary concretions, small irregular tubes are sometimes found which closely resemble those described in the animal matter of shell and coral. Epithelial scales, mucous globules, and portions of tissue similar to those which may be observed floating in the urine of persons labouring under calculous disease, are sometimes to be observed in the animal matter. Their presence is, however, by no means constant, and the purer the calculus the rarer do they become; they are most commonly met with in submaxillary calculi, and in

* As determined by J. S. Bowerbank, Esq., F.R.S.

urinary concretions consisting of the mixed phosphates*. The constant presence of animal matter in these concretions, and the uniform manner in which it is diffused throughout their substance, would render it probable that it is an *essential* constituent†.

The calculi in this collection are classified according to their chemical composition, and are marked by letters and numbers in a similar manner to that adopted with the human urinary concretions. A large number are without any history, and several are ascribed to animals in which it is scarcely possible that they could have occurred. In the following Table all the calculi in the collection from the lower animals are included, and a point of interrogation (?) is affixed to those whose assigned origin is doubtful.

	Uric acid and urates.	Oxalate of lime.	Phosphate of lime.	Phosphate of magnesia and ammonia.	Mixed phosphates.	Carbonate of lime and magnesia.
Monkey (*Simia*)	....		....	....	1	
Dog (*Canis familiaris*)	....		....	3	3	
Rat (*Mus decumanus*)						
Rabbit (*Lepus cuniculus*)	....		1?			
Hog (*Sus scrofa*)	....		....	1	1	5
Horse (*Equus caballus*)	....		....	....	1?	16
Ass (*Equus asinus*)	....		....	....	....	1
Ox (*Bos taurus*)	....	2	....	....	1?	11
Sheep (*Ovis ammon*)	1?					
Elephant (*Elephas Indicus*)	....		....	....	....	1
Whale	....		....	1		
Eagle (*Aquila*)						
Ostrich (*Struthio camelus*)	1					
Fowl (*Phasianus gallus*)						
Tortoise (*Testudo*)	....		....	....	....	1
Iguana (*Iguana tuberculata*)	3					
Sturgeon (*Acipenser sturio*)	....		2			

From the above Table we learn that graminivorous animals are most liable to calculous disease, and also that the greater number of calculi from the lower animals consist of carbonate of lime.

* The above-mentioned facts, with regard to the animal matter, were not observed until the first part of the Catalogue had been published. Although the subject is still under examination, and the nature of the tubular bodies cannot be regarded as decided, it has been considered advisable to give a general account of them in this place.

† The idea that calculi possess an organized structure is by no means new, and has been advocated by several authors, especially by Walther, who has endeavoured to show that urinary sediments and calculi are formed in a totally different manner.—*Journal der Chirurgie*, B. i. S. 189 *et seq.*

CALCULI CONSISTING OF URIC ACID AND ITS COMPOUNDS.

These substances, which form so large a proportion of the calculi from the urinary organs of Man, are very rarely found in those of the lower animals. The only specimens of this description in the Museum are from the Ostrich, from a species of Iguana, and from the Sheep. With regard to the calculus from the Sheep, it is exceedingly doubtful whether it was actually taken from that animal, although it has been retained in this place on the authority of the MS. Catalogue. Crystals of uric acid were found in a calculus from the Whale, and were apparently deposited between the layers of triple phosphate of which the bulk of the calculus consisted.

One of the most interesting facts that has arisen from the examination of this Collection, has been the discovery of three calculi composed principally of urate of potass. Two of these calculi are stated to have been taken from the bladder of the Iguana ; the third is without any history, but agrees with the other two both in chemical composition, structure and general appearance, although it is much larger. These concretions are of an oval shape, one side being considerably flattened so as to give their transverse section a pyriform figure. Their structure is laminar, except at the centre, where it is loose and granular. They are of a dirty white colour; in their general appearance they resemble phosphatic concretions, and were described as such in the MS. Catalogue. Vide p. 142, Plate XIII. figs. 8, 9.

Uric acid concretions appear to have been met with most frequently in the Dog. Lassaigne analysed a calculus taken from that animal by M. Gerard, the Director of the Royal Veterinary School at Paris, which contained 58 per cent. of uric acid in combination with ammonia*; and another specimen derived from an equally authentic source consisted almost entirely of sub-urate of ammonia †.

* *Journ. de Chém. Méd.*, tom. iv. p. 361. Lassaigne states that this calculus contained 30·8 per cent. of ammonia; a quantity which, as is observed by L. Gmelin, *Handbuch der Chemie*, is incredible. The ammonia not having been estimated directly, it is most probable that both animal matter and water are included in this estimate.

† *Annales de Chimie*, tom. ix. p. 324.

Uric Acid.

P 1. Some small masses of a loosely cohering and readily friable deposit which were found in the bladder of an Ostrich.

Uric acid mixed with animal matter and traces of urate of ammonia and phosphate of lime; some colouring matter is also present, which, although rendered of a green colour by muriatic acid, differs from the colouring matter of the bile. *Hunterian.*

Urate of Ammonia.

P 2. A section of a small calculus composed of urate of ammonia. This calculus is said to have been taken from the kidney of a Sheep. "The kidney was greatly enlarged and its substance very tender and brittle." *Hunterian.*

P 3. Some small masses of uric acid and urate of ammonia, which were "found in the rectum of a Fowl." *Hunterian.*

P 4. Ditto. From the rectum of an Eagle. *Hunterian.*

P 5. Dried masses of the semifluid urine of the Boa Constrictor. This substance consists principally of suburate of ammonia. *Presented by W. Clift, Esq.*

Urate of Potass.

The following calculi are the only instances that have been hitherto discovered of uric acid in combination with potass. They bear a striking resemblance to each other in their structure and general appearance, and have been doubtless taken from the urinary bladder of some of the species of Iguana that are found in South America.

P 6. A calculus of a flattened oval figure, described in the Sloanian MS. Catalogue as "Piedra de Yguana. From Mr. Houston, from Cartagena in America." It was accompanied by a description, in very bad Spanish, of its virtues as a remedy for the stone and gravel, with the mode of using it. It is composed of urate of potass mixed with urate of ammo-

nia and urate of lime, and gave the following results by analysis (Vide Plate XIII, fig. 9):—

Uric acid with a trace of oxalate of lime	78·64
Potass	10·42
Ammonia	3·10
Lime	1·89
Phosphate of lime	0·32
Water	1·67
Animal matter	2·73
	98·77

British Museum.

P 7. A small calculus consisting of urate of potass, which resembles the former specimen in general appearance, but is rather more dense. It had the following memorandum in the Sloanian MS. Catalogue:—"Esta piedra de Yguana servi para el mal d'Orina. From Mr. Houston, from Cartagena in America." *British Museum.*

P 8. This calculus was placed by Mr. Hunter among the human urinary concretions, but as it only differs in size from the two last described specimens, it is most probable that it has also a similar origin. It measures two inches and a quarter in length by two inches across, and is of an oval figure, having one of its sides flattened; when submitted to analysis its constituents were found to be as follows:—

Uric acid mixed with a trace of oxalate of lime.	78·36
Potass	13·19
Ammonia	3·09
Lime	1·49
Magnesia	0·29
Phosphate of lime	0·02
Animal matter	1·80
Water	0·43
Sulphate of soda with chloride of sodium	traces
	98·67

Hunterian.

CALCULI CONSISTING PRINCIPALLY OF OXALATE OF LIME.

Oxalate of lime is most frequently found in calculi consisting chiefly of carbonate of lime, especially in those taken from the Horse. It may often be observed scattered over the surface of these concretions in the form of minute transparent octohedral crystals.

As forming the principal constituent of a calculus, oxalate of lime is of rare occurrence; the only specimens of this description in the Museum were taken from the ureter of the Hog, and one of them is figured in Plate XIII. Lassaigne detected 53 per cent. of this salt mixed with phosphate of lime and animal matter in some small calculi from the urethra of a Dog*; and according to Fourcroy and Vauquelin, it is also found in the urinary concretions of Rats†.

Q. *Oxalate of Lime.*

Q 1. A small tuberculated calculus consisting of oxalate of lime. "Taken out of the ureter of a Hog."—*Sloanian MS. Catalogue.*

British Museum, 1809.

Q 2. A similar concretion, also consisting of oxalate of lime, taken from the ureter of a Hog. "Given me by Mr. Morton, Northamptonshire." —*Sloanian MS. Catalogue.* *British Museum.*

CALCULI CONSISTING OF CYSTIC OXIDE.—CYSTINE.

Lassaigne has described a calculus from the bladder of a Dog which possessed the general chemical characters of cystic oxide. Its elementary composition, however, as determined by Lassaigne, is so entirely different, that considerable doubt must be entertained as to its identity with the cystic oxide of Wollaston‡.

CALCULI CONSISTING OF URIC OXIDE.—XANTHIC OXIDE.

Until very recently this substance had been only found in urinary calculi from Man. In a communication to the Academy of Sciences at Berlin, Prof. Magnus announced that uric oxide had been detected by M. Unger in guano, the decomposed excrement of sea-birds§.

* *Journ. de Chim. Méd.* tom. v. p. 633.

† Gmelin, *Handbuch der Chemie.*

‡ *Ann. de Chimie et Phys.*, xxxiii. 328.

§ Poggendorff's *Ann.*, lxii. 158. 1844.

CALCULI CONSISTING OF PHOSPHATE OF LIME.

Phosphate of lime in a pure state is found as infrequently in the urinary organs of the lower animals as in those of Man. Dr. Thomson analysed a calculus from the urethra of a hog which consisted entirely of phosphate of lime and animal matter. It was of a white colour, of a nearly spherical figure, and was made up of a congeries of very small needles which had a silky lustre. The only concretions in the Museum which belong to this class, with the exception of one said to have been taken from the bladder of a rabbit, are those which have been designated *Beluga stones.* These calculi are found by the fishermen of the Caspian Sea and of the Volga in a species of Sturgeon (*Acipenser Huso,* Linn.). The statements of different authors as to the situation of the stone in the fish, are very conflicting, some describing it as occurring in the air-bladder, others in the head and stomach. In Schrober's *Memorabilia Russico-Asiatica,* as quoted by Klaproth, it is said to be most frequently found in a small pouch communicating with the pancreatic duct; his description is however confused and anatomically incorrect. The subjoined extracts from the works of Pallas* leave no doubt as to these concretions being taken from the dilated ureter or from the common cloacal termination of the gut of the fish.

These concretions have generally a flattened oval figure, their centre being often

* "Les pêcheurs rencontrent assez souvent dans les gros biélougas, la pierre dont j'ai parlé, qui est encore un problème. Ils la vendent à un prix assez modique, de doux à trois roubles. Tous les pêcheurs à qui j'en ai parlé, m'ont assuré qu'on la trouve dans le gros boyau, qui leur sert à se vider et à jeter leurs œufs. On rencontre quelquefois des pierres dans les gros esturgeons ordinaires; elles sont semblables à celles des biélougas. On en trouve aussi dans les gros barbeaux, mais elles sont d'une espèce différente. Les pierres de biélouga sont ovales, unies, et quelques-unes grumelés assez grossièrement; d'autres sont triangulaires et toutes plates. Cette variété, dans la forme et la place qu'elles occupent, prouve que c'est une vraie pierre, et non une arête. Elles ont toutes la couleur et la texture de l'arête. Lorsqu'on les brise, on trouve dans leur substance des rayons luisans spathiques qui tendent de la circonférence au centre; outre la texture écailleuse qu'on destingue à la première superficie, il se détache de l'intérieur de quelques-unes de ces pierres un noyau; il a la même substance que la pierre, mais une autre forme; il ne se trouve pas toujours au centre. J'en ai vu plusieurs qui pesoient jusqu'à trois onces; je les croyois plus pesantes d'après leur grosseur. On peut en raper avec la lame d'un couteau, mais avec peine. J'ai essayé d'en mettre dans des acides et je n'y ai apperçu aucune marque d'effervescence. En Russie, on se sert de cette pierre comme remède domestique, dans les accouchemens laborieux, pour les maladies de l'urètre et celles des enfans; il est très en vogue, et l'on a grand tort. On en fait prendre dans de l'eau à tres-petite dose. On attribue les mêmes vertus, et nombre d'autres, à la pierre qu'on rencontre quelquefois dans la vessie

depressed or slightly concave. They vary considerably in size, but are usually about that of a hen's egg. Their surface is unequal but quite smooth, and of a yellowish-white colour. When broken they present a highly crystalline structure, consisting of fine plates or needles radiating from the centre to the circumference, but which are made up of very thin concentric layers adhering firmly together. Fragments of these calculi are translucent, and their interior is of a pure white colour. They are exceedingly scarce, and are highly esteemed for their supposed medicinal virtues. Dr. Cook informs us that the powder is highly commended as a diuretic and lithontriptic, and that the common people in the neighbourhood of the Volga take from ten to sixty grains, scraped fine in a little water, three or four times a day when the case is dangerous *.

The composition of these calculi was first determined by Klaproth, but the earliest description of them is to be found in the Philosophical Transactions for 1748.

The specimen analysed by Klaproth had been received from Prof. Pallas. It weighed above seven ounces troy, and consisted of Albumen 1, Water 24, Phosphate of lime 71·50, Sulphate of lime 0·50 †.

urinaire des sangliers, qu'on appelle Kabannoï Kamen, pierre de sanglier; elle est beaucoup plus chère que celle du biélouga."—*Voyages de Pallas*, tom. i. p. 683.

"On fend le cartilage du dos pour en retirer les nerfs; on les lave et étend sur des perches pour les faire sécher.

"C'est en partageant ce cartilage dans toute sa longueur que l'on trouve quelquefois dans les plus gros ichthyocolles cette pierre si vantée. On ne l'apperçoit que lorsque le couteau s'arrête au moment où il la touche. Cette pierre est renfermée dans la chair rouge glanduleuse, qui est adhérente à la partie postérieure de l'épine du dos, et elle tient lieu de rognons. Elle est dans un petite peau particulière, qui remplit l'intérieur de cette espèce de glande. Je rapporte ici ce que M. Sokolof a pu apprendre de plus certain sur sa vraie position, des pêcheurs les plus instruits, qui assuroient en avoir trouvé quelques-unes. A l'extérieur, elle est un peu molle et humide lorsqu'elle est fraichement tirée, mais elle durcit aussitôt qu'elle est à l'air. C'est dans les pêches qui se font près d'Astrakan qu'on la rencontre le plus souvent. Elle n'est jamais plus grosse qu'un œuf de poule. Elle est ovale et assez plate un peu concave; où elle a l'angle qui adhère au cartilage un peu courbé."—*Voyages de Pallas*, 1789, vol. ii. p. 486.

"In visceribus uropoeis Husonum maximorum et ætate provectiorum sæpius reperitur *Calculus* ovalis, depressus, hinc concavus, solidus, albus, intus Zeolithi fere instar a centro radiatus, nitidusque, cujus chemica analysis adhuc deest. Hunc plebs Rossica, et honoratiores etiam, pro magno medicamento uragogo et partium promovente æstimant atque infantibus propinant, unde a piscatoribus pretio non exiguo redimuntur, *Calculi Husonis* (Bjelushie Kamen) nomine."—*Zoographia Rosso-Asiatica*, vol. iii. p. 87.

* Phil. Trans. vol. xliv. p. 451.

† *Chemische Abhandlugen*, B. vi. S. 224.

17·13 grs. of one of the specimens in this collection, previously calcined, gave by solution in dilute muriatic acid and precipitation by oxalate of ammonia, 13·87 grs. of carbonate of lime, which is = 17·54 of the diphosphate of lime: 100 grs. of the same calculus gave—

		By calculation.
Water	26·33	25·60 = 5 atoms.
Organic matter	0·40	1·13
Diphosphate of lime	73·27	73·27 = 1 atom.
	100·00	100·00

The Beluga stones therefore consist of an atom of diphosphate of lime combined with 5 atoms of water. The water is necessarily over-estimated in the analysis, on account of the organic matter being partially soluble in the diluted acid.

The great purity of these calculi, together with their transparency and the facility with which they dissolve in diluted acids without causing any effervescence, renders them peculiarly fitted for observing the manner in which the animal matter is combined with the earthy constituents of the calculus. If a small splinter of the calculus is placed under the field of the microscope, and a drop of muriatic or nitric acid, previously diluted with about twenty parts of water, be added, the earthy phosphate begins immediately to dissolve, and the progress of the solvent action is shown by the increased transparency of the sides and angles of the fragment, and by the gradual retrocession of the dark line which marks the boundary of the undissolved portion. A delicate skeleton of animal matter is left which retains for some time the exact figure, size, and general appearance of the original fragment, until at last it becomes broken up and dissolved by the action of the acid. The animal matter viewed in this manner has the form of a fine transparent and slightly granular tissue, marked by some short parallel lines running from the centre to the circumference of the calculus, together with a few transverse lines which indicate the direction of the concentric layers. The membrane is however quite continuous, and cannot by any artifice be made to separate in any particular direction.

If a rather thicker portion of the animal matter be placed between two slips of glass, the radiating lines appear so close together as to give the membrane somewhat of a fibrous structure.

R. *Phosphate of Lime.*

R 1. A portion of one of the concretions that are occasionally found in the dilated ureter of the Sturgeon. For the history of these singular concretions, together with the analysis of this calculus, vide p. 144. It was labelled "From the Sturgeon, Mosco." Vide Plate XIII. fig. 3.

Hunterian.

R 2. A portion of a similar concretion. "From the Beluga, Mosco." It consists of diphosphate of lime, 73·64; water and organic matter, 26·36.

Hunterian.

R 3. A round mammillated calculus, composed of phosphate of lime mixed with carbonate of lime and a little phosphate of magnesia and ammonia, with a considerable portion of animal matter. It is stated in the MS. Catalogue to have been taken from the bladder of a Rabbit.

Hunterian.

CALCULI CONSISTING PRINCIPALLY OF PHOSPHATE OF MAGNESIA AND AMMONIA.

Calculi consisting of this salt are found of considerable purity in the bladder of the Dog and the Hog. They are of a pure white colour, and are either opaque or semi-transparent. In the former case they usually contain some phosphate of lime, but, with the exception of their containing a large [illegible] of animal matter, they are for the most part remarkably pure. Their [illegible] invariably crystalline, frequently consisting of broad plates radiating from the centre to the circumference of the calculus. M. Caventou analysed a [illegible] from the Hog which consisted of 99·5 of crystallized triple [illegible] of animal matter. The specimen in this Collection from the [illegible] pure*. The concretions from the Dog are sometimes of very large [illegible] one in the Museum which weighs above twelve ounces troy.

S. *Phosphate of Magnesia and* [illegible]

S 1. A large flattened white calculus tuberculated [illegible] This calculus was taken from the bladder of a Spaniel [illegible] been [illegible]

* Jour[illegible]

served to void bloody urine for the space of three years, during the whole of which time it was employed in the chase; the animal's sufferings becoming extreme it was killed, and the calculus was found to occupy nearly the entire cavity of the bladder.

Phosphate of magnesia and ammonia with a trace of phosphate of lime and animal matter.

Presented by Sir John Cox Hippisley, Bart., 1820.

S 2. A large oval calculus, taken out of the bladder of a large Mastiff Dog supposed to be nearly twenty years of age; it measures four inches in its long diameter by three inches and two inches and a half in its short diameters, and weighs more than twelve ounces troy.

Phosphate of magnesia and ammonia nearly pure. *Hunterian.*

S 3. A large oblong calculus "taken out of a sickly dog's bladder."—*Sloanian MS. Catalogue.*

Phosphate of magnesia and ammonia mixed with some phosphate of lime and animal matter. *British Museum*, 1809.

S 4. A small oval calculus, stated to have been taken from the stomach of a Hog, but it is doubtless from the urinary bladder.

Crystallized phosphate of magnesia and ammonia upon a small nucleus of carbonate of lime. *Mus. Leverian*, 1806.

S 5. A calculus having the form of a three-sided prism with rounded angles. It is of a white colour, about one inch and three quarters in length, and has a compact lamellated structure. It consists of phosphate of magnesia and ammonia mixed with a small quantity of phosphate of lime and animal matter. It also contains a notable quantity of uric acid deposited between its layers in the form of small radiating prismatic crystals.

This calculus was taken from the urinary bladder of a Whale, which had been brought to Newport, Long Island, North America, and the calculus was sent to Boston by Dr. Jackson of Newport. The bladder contained about a bushel full of calculi, some larger, and others smaller than the present specimen.

Presented by the Boston Medical Society, 1844.

CALCULI CONSISTING OF THE MIXED PHOSPHATES.
FUSIBLE CALCULUS.

The general appearance and chemical characters of these calculi are precisely similar to those which occur in the human subject. The greater number are from the Dog, and it is probable that they are only found in carnivorous and omnivorous animals. There is however a small concretion of this kind in the Museum which was taken from a Monkey, and some others stated in the Sloanian MS. Catalogue to have been found in the bladder of a Horse.

T. *Mixed Phosphates.*

T 1. A section of a large oblong calculus composed of the mixed phosphates. This calculus is described in the Sloanian MS. Catalogue as from the human subject, but it has most probably been taken from the Dog.
British Museum, 1809.

T 2. An oval "stone taken out of the bladder of a Lap-Dog ; from Mr. Dartiknave."—*Sloanian MS. Catalogue.*
Mixed phosphates. *British Museum*, 1809.

T 3. A small triangular-shaped calculus, consisting of the mixed phosphates, taken from the bladder of a Dog.—*Sloanian MS. Catalogue.*
British Museum, 1809.

T 4. An irregularly-shaped calculus from the Monkey, and apparently from the kidney : it consists of the phosphates mixed with urate of ammonia.
Hunterian.

T 5. "Three triangular stones taken out of a Horse's bladder."—*Sloanian MS. Catalogue.* They consist of the mixed phosphates with animal matter.
British Museum, 1809.

T 6. Six small calculi described in the Sloanian MS. Catalogue as "calculi exigui magnitudinem lentium non superantes rubelli ex vesicâ bovinâ."
They consist of the mixed phosphates, and contain urate of ammonia, which renders their assigned origin rather doubtful.
British Museum, 1809.

T 7. A large white calculus of a flattened circular figure, consisting of the fusible compound, mixed with carbonate of lime and a little animal matter. It is described in the Sloanian MS. Catalogue as "an occidental bezoar from Buenos Ayres. From Mr. Ranby."

British Museum, 1809.

T 8. Two fragments of bone encrusted by the mixed phosphates; they appear to have been portions of a fœtal cranial bone, and in the Sloanian MS. Catalogue are stated to have been "taken out of a Hog's bladder, vide the Natural History of Lancashire, Lee." *British Museum*, 1809.

T 9. A small flattened oval calculus, consisting of phosphate of magnesia and ammonia mixed with some phosphate of lime.

Presented by W. T. Brande, Esq., 1841.

CALCULI CONSISTING OF CARBONATE OF LIME, OR OF CARBONATE OF LIME MIXED WITH CARBONATE OF MAGNESIA.

Carbonate of lime forms by far the greater proportion of the concretions from the urinary organs of herbivorous animals. It has never been found in those from the carnivorous tribe; and the fact of the urine of these animals being almost invariably acid, renders it improbable that such should occur. In the Graminivora, on the other hand, whose urine is alkaline, the deposition of carbonate of lime is by no means infrequent; and large quantities of this salt are frequently deposited from the urine of these animals upon standing, which even when first passed is often turbid from the same cause. Of the domestic animals, the Horse and Ox appear to be most liable to these deposits; in the Museum there are also specimens of them in the sedimentary form from the Rhinoceros and the Elephant.

From the Horse (*Equus caballus*).—Calculi from the kidney of the Horse are of very common occurrence, and are easily recognised by their twisted, branched and otherwise irregularly-shaped appearance. They usually form a single mass which often attains a very large size, weighing several pounds. Their external surface is in some parts smooth and polished, in others granular, rough and tuberculated They are exceedingly hard, and when broken present a compact, rudely laminated and sometimes nodulated structure, with a coarse earthy

fracture. Both the exterior and interior of these calculi are of a dirty yellow colour. Concretions similar in composition to, and in many respects resembling those from the kidney, are sometimes taken from the bladder of the Horse. These calculi have usually an ovoid figure. Their texture is in some instances compact, while in others it is porous and granular. They usually present when divided a coarsely radiated and lamellar structure. Vide Plate XIII. fig. 10, 11.

The calculi from the Horse consist of carbonate of lime mixed almost invariably with a small quantity of carbonate of magnesia, and a rather considerable proportion of animal matter. Traces of phosphate, oxalate and sulphate of lime, with the various saline ingredients of the urine, may often be detected. Crystals of oxalate of lime are occasionally scattered over the exterior of the concretions from the bladder.

When a portion of one of these calculi is dissolved in dilute muriatic acid, a mass of organic matter is left, which retains the form of the original fragment, and is seen to consist of successive layers of a fine membrane. When one of the layers is examined by the microscope, it presents the form of a granular transparent membrane, upon which are placed, at irregular distances, and varying in size, a number of nearly circular rings, the centres being almost transparent, while each ring is formed by two or more concentric lines, giving them somewhat the appearance of spheroidal epithelial particles. The animal matter is insoluble in water; when placed in a weak infusion of galls, it becomes much firmer in texture, but its aqueous decoction does not give any precipitate with the same test.

From the Ox (*Bos Taurus*).—Carbonate of lime concretions from the Ox are seldom of large size. Those from the kidney rarely exceed an inch in length, while those found in the bladder are usually about the size of peas. The latter generally occur in great number, often amounting to several hundreds. They are small rounded globules, usually quite smooth and polished on their surface, but occasionally tuberculated, in which case they resemble *mulberry* concretions. These calculi, whether occurring in the bladder or in the kidney, are generally remarkable for presenting a pearly pseudo-metallic exterior, which gives them the appearance of being slightly gilded or silvered. When broken they readily separate into thin concentric layers, which exhibit a similar lustre on their inner and outer surfaces. The tuberculated calculi, on the contrary,

[illegible]

[illegible]

[illegible] carbonate of lime and from the ordinary [illegible] of the Hog. These [illegible] in size [illegible] egg. Their exterior is granular or [illegible] and when sawn through exhibit a compact [illegible] the appearance of indistinct lines radiating from the [illegible]. They always contain a small proportion of carbonate of magnesia, and in their general chemical composition [illegible] from the Horse and Ox. Vide Plate XIII. figs. 1, 2.

[illegible] Carbonate of Lime.

[illegible] A stone taken out of the bladder of a Hog.—[illegible] MS. Catalogue. [illegible] of lime with a little carbonate of magnesia and a large quantity of animal matter. *British Museum*, 1809.

[illegible] [illegible] calculi taken from the bladder of a Hog. Carbonate of lime mixed with some carbonate of magnesia. 1838.

[illegible] [illegible] sections of urinary calculi from the Hog, consisting of carbonate of lime mixed with some carbonate of magnesia. Vide Plate XIII.
Presented by Dr. H. Richardson, 1842.

V [illegible] "A stone from the kidney of a Mare, three years old, weighing eight

ounces, cut out of a mare which died in Hertfordshire of a total suppression of water. Given to me by Dr. Quinten."—*Sloanian MS. Catalogue.*

Thirty grs. by analysis yielded—

Carbonate of lime	26·11
Phosphate of lime, with a trace of peroxide of iron . .	0·20
Carbonate of magnesia	0·32
Animal matter, insoluble in water	1·00
Water	0·70
Loss, consisting principally of animal matter soluble in water	1·67
	30·00

Vide Plate XIII. *British Museum,* 1809.

The following calculi are similar in composition to the above, but differ slightly in the relative proportion of the earthy carbonates, the carbonate of lime being always the most abundant.

V 5. "The Hippolithos, or a stone taken from the kidney of a Horse. Given me by Sir Wm. Gifford, who brought it from Portsmouth."—*Sloanian MS. Catalogue.* *British Museum.*

V 6. A large calculus, and several small irregularly-shaped calculi having smooth articulating surfaces. The large calculus was described in the Sloanian MS. Catalogue as "a rough stone taken out of the bladder of a Horse. Given me by Lord Walpole." They are evidently from the kidney. *British Museum,* 1809.

V 7. A large renal calculus, having several smooth depressions on its surface, probably from the Horse. *Hunterian.*

V 8. A large calculus, taken evidently from the kidney of a Horse. *Hunterian.*

V 9. A large calculus, taken probably from the kidney of a Horse. *Museum, Leverian,* 1806.

V 10. A renal calculus, described in the Sloanian MS. Catalogue as from the human subject, but it resembles in every respect the concretions from the kidney of the Horse. *British Museum,* 1809.

V 11. An oval calculus, having a rough tubercular surface. It is composed of carbonate of lime with carbonate of magnesia, and was "voided from the bladder of a five-year old mare, after frequent stopping to stale and staling blood. From Mr. Alderman Wilberforce in Hull."—*Sloanian MS. Catalogue.* *British Museum*, 1809.

V 12. A section of a urinary calculus, which was removed from the bladder of a Horse by an incision through the rectum. The animal belonged to His Majesty King George the Third, and the operation was performed by a German veterinary surgeon. The animal died from peritoneal inflammation, apparently produced by the turpentine dressings introduced into the wound having reached into the cavity of the bladder.

Carbonate of lime mixed with some carbonate of magnesia and a little oxalate of lime. Crystals of oxalate of lime are scattered over its exterior. *Presented by Everard Home, Esq.*, 1807.

V 13. A large calculus, having a tubercular surface. It is composed of carbonate of lime mixed with some carbonate of magnesia: probably from the Horse. *Hunterian.*

V 14. An oval-shaped calculus, having a similar structure and composition to the preceding: probably from the Horse. Its surface is slightly tubercular. *Hunterian.*

V 15. Two small calculi, consisting principally of carbonate of lime, and taken apparently from the kidney of a Horse. *Hunterian.*

V 16. A small calculus, chiefly composed of carbonate of lime: probably from the Hog. *Hunterian.*

V 17. A urinary calculus of a large size, and of a regular oval figure. The nucleus consists of a mass of loosely cohering sediment, which is surrounded first by a granular and very dense deposit, and lastly by thin concentric laminæ. It is composed throughout of carbonate of lime mixed with some carbonate of magnesia. In the Sloanian MS. Catalogue this calculus is described as "an Elephant's bezoar, very large."

British Museum, 1809.

V 18. Masses of a light yellow-coloured earthy sediment, which were found in a pulverulent state in the bladder of a Horse. The bladder was very much enlarged, but its inner surface did not present any unusual appearance.

Carbonate of lime with animal matter, traces of phosphate of lime and peroxide of iron. *Presented by Sir Wm. Blizard,* 1811.

V 19. A mass of urinary sediment, taken in the pulverulent form, from the bladder of a Horse: it is nearly similar in colour and in composition to the former specimen. *Presented by Sir Wm. Blizard,* 1812.

V 20. An exceedingly dense concretion of a regular oval figure, composed throughout of carbonate of lime mixed with a large quantity of carbonate of magnesia. The nucleus and exterior of this calculus consist of thin concentric layers of a light brown colour, and are very compact. The middle and greater portion of the calculus has a radiated structure, the radii being intersected by concentric waved lines. From what animal is unknown, but it resembles in many respects V 17. Concretions similar to these in structure occur in the bladder of the Horse. *Hunterian.*

V 21. A small concretion, which with twenty others was taken from the kidney of an Ox. It consists of carbonate and oxalate of lime.

British Museum.

V 22. Three small renal calculi, described in the Sloanian MS. Catalogue as "calculi ramosi armaturâ æneâ ex renibus bovinis. From Dr. Lavater." The pearly or pseudo-metallic appearance of the exterior of these and the six following calculi is apparently produced by thin films of animal matter intervening between their layers. They are composed of carbonate of lime with some carbonate of magnesia, and their animal matter resembles in structure that of pearls. *British Museum,* 1809.

V 23. "Calculi pisales conglobati læves colore æneo nitentes, ex vesicâ bovinâ. From Dr. Lavater."—*Sloanian MS. Catalogue.*

They consist principally of carbonate of lime.

British Museum, 1809.

V 24. "Calculi lentiformes læves splendore nigricante plumbeo armati, ex vesicâ bovinâ. From Dr. Lavater."—*Sloanian MS. Catalogue.*

Carbonate of lime mixed with carbonate of magnesia and a little phosphate of lime. *British Museum*, 1809.

V 25. "Calculi magnitudine fabæ armaturâ flavâ splendide obducti, veluti in vernice, ex vesicâ bovinâ. From Dr. Lavater."—*Sloanian MS. Catalogue.* Carbonate of lime, with a little carbonate of magnesia.
British Museum, 1809.

V 26. "Small gold-coloured stones out of the bladder of an Ox, 1674."—*Sloanian MS. Catalogue.* Composition similar to the preceding.
British Museum, 1809.

V 27. Several small round calculi, composed principally of carbonate of lime. "Ex rene bovis. From Dr. Scheuchzer."—*Sloanian MS. Catalogue.*
British Museum.

V 28. "Calculi pisales læves, splendore pallido nitentes, ex vesicâ bovinâ."—*Sloanian MS. Catalogue.* Carbonate of lime containing carbonate of magnesia and a trace of phosphate of lime. *British Museum*, 1809.

V 29. Several small concretions, supposed to have been taken from the kidney or bladder of an Ox. They consist of carbonate of lime mixed with some carbonate of magnesia. *Hunterian.*

V 30. Numerous small round calculi, the largest of which are tuberculated on their surface. They were taken from the bladder of an Ox, and are composed of carbonate of lime mixed with carbonate of magnesia.
Hunterian.

V 31. Several small spherical concretions. "From the bladder of an Ox." Composition similar to the preceding. *Hunterian.*

V 32. Some small concretions, taken from the prepuce of the Hermaphrodite Ass, described by Mr. Hunter in the Philosophical Transactions. Carbonate with a trace of phosphate of lime. *Hunterian.*

V 33. Several small flattened concretions "taken out of the bladder of a Tortoise."—*Sloanian MS. Catalogue.* They do not possess a lamellar structure, and are composed of carbonate of lime with animal matter.
British Museum, 1809.

V 34. A urinary calculus from an Otaheitian Pig. This calculus in its general appearance and chemical composition resembles that figured in Plate XIII., but it is much larger. *Presented by Everard Home, Esq.*, 1807.

V 35. Pulverulent deposit taken from the bladder of a Horse, the bladder being much enlarged. It consists principally of carbonate of lime.
Presented by Everard Home, Esq., 1807.

V 36. Sediment from the urine of a Rhinoceros which was exhibited at the Lyceum in the Strand in the year 1792. The animal was of the single-horned African species. Its urine was very turbid when passed, and when this deposit was taken the animal was so weak that it was obliged to be supported by slings; it died shortly after. The sediment consists almost entirely of carbonate of lime mixed with a little oxalate of lime. The carbonate of lime is in the form of small prismatic crystals and of minute rounded globules. *Hunterian.*

V 37. A small quadrilateral-shaped calculus, consisting of carbonate of lime.
Presented by W. T. Brande, Esq., 1841.

V 38. Two small irregularly-shaped concretions taken from the kidney of a Cow. Their surface is extremely rough and tubercular, and they are composed of carbonate of lime mixed with a little carbonate of magnesia and animal matter. *Presented by J. D. Hudson, Esq.*, 1844.

CALCULI CONSISTING OF SILICA.

M. Lassaigne has described a calculus composed of silica mixed with a little peroxide of iron and animal matter. It was found in the urethra of a male Merino lamb. It was of a white colour with a slight shade of red, very friable, and had a cylindrical figure tapering towards the extremities. It was made up of concentric layers which adhered very slightly to each other.—*Ann. de Chim. et de Phys.* xliv. p. 420.

PART II.

Division I.

CALCULI FROM THE DIGESTIVE TRACT OF MAN.

FROM THE BILIARY ORGANS.

INTRODUCTION.

THE concretions which sometimes form in the gall-bladder and in the biliary ducts do not appear to have attracted the notice of physicians at so early a period as those of the kidney and urinary bladder. According to Dr. Coe, whose Treatise on Biliary Concretions, published in 1757, contains the largest amount of historical information on this subject, no mention is made of these bodies in the writings of the ancients, and he believes that the earliest notice of them is to be found in the works of Benevenius, Fallopius, Vesalius and Fernelius, who lived about the middle of the fifteenth century. Benevenius speaks of a "large black calculus of the size of a chestnut found in the gall-bladder of a woman, and that there were in the same subject many stones contained in a pendulous bag formed of the membrane that covered the liver*." To Fernelius, however, Dr. Coe attributes the principal merit of directing the attention of the medical profession to gall-stones as a source of disease, and also believes that Fernelius was the first to observe that they were occasionally voided by stool.

In Gesner's *De omni Rerum Fossilium Genere*, there is a dissertation by Kentmann on several species of calculi found in the human body, and amông them

* *De abditis Morborum causis*, cap. 94, as quoted by Dr. Coe.

those of the gall-bladder are noticed. This treatise was published in 1565, about seven years after the death of Fernelius.

The importance of the liver as an excretory organ and its influence on digestion, together with the severe pain and symptomatic fever attending the passage of a gall-stone through the biliary ducts, contributed to render the bile and biliary concretions a favorite subject of speculation with a large number of medical authors. S. T. Sœmmering, in a very excellent monograph entitled *De Biliariis Concrementis Corporis Humani*, published in 1795, has taken the pains to collect above two hundred references to different works on this subject. In all of these we find more or less accurate descriptions of the form, size and general appearance of biliary calculi, but without any information as to their chemical nature. Dr. Coe, writing in 1757, says, that "they evidently consist of the gross tenacious dregs of bile, and an earthy substance separated from the blood of a similar nature to that of which the urinary calculus and the gouty chalk-stones are composed." In fact, prior to the experiments of Fourcroy in 1798, the general opinion appears to have been that they were composed of inspissated bile, although the simplest experiment would have shown that the bile, when reduced to the state of an extract, forms a highly soluble and even deliquescent mass, and was not therefore very likely to become a solid concretion. It is however still more remarkable that this unmeaning term has been applied by a modern author to the ordinary gall-stones of oxen, and is even at the present time in general use. About the year 1785 Poulletier de la Salle first observed that the greater number of biliary calculi were soluble in hot alcohol, and that upon cooling a number of brilliant crystals, like those of benzoic acid, were separated. He also ascertained that this substance was not present in the gall-stones of oxen. The latter concretions had been known most probably much earlier than those of the human subject, but had always been considered as similar to those from Man. These facts were communicated by Poulletier de la Salle to Fourcroy, who conceived that the crystalline matter was analogous to spermaceti and a fatty matter which he had procured from putrid liver and brain, to which he had given the generic name of *adipocire*. These calculi he therefore termed adipocerous*.

* *Syst. des Connaissances Chimiques.*

The experiments of Fourcroy on biliary calculi appeared at the same time as those on urinary concretions. They are however of much less value than the latter, and in his haste to generalize, he fell into numerous errors. A much better description of the principal constituent of human biliary calculi had been previously given by C. Gren* in 1788, who merely called it a waxy-looking substance. It was afterwards shown by Chevreul, in his celebrated Essay on Fatty Bodies, that the crystallizable fatty matter was a peculiar substance, to which he gave the name of cholesterine, by which title it is now universally known†.

Although it had been ascertained by Poulletier de la Salle that the biliary calculi of the Ox are very different in composition from those of the human subject, it was not until the year 1806 that their composition was determined, when Thenard showed that they consist of the same matter that gives to bile its usual brown colour‡. Oxen are particularly subject to concretions in the gall-bladder, great numbers of which are imported into this country from Germany for the use of painters. Glisson asserts that they are met with principally in the winter, when the animals are fed chiefly upon hay and straw, and that upon the approach of spring, or as soon as they are fed upon fresh grass, the calculi disappear, being dissolved and expelled by the fresh juices of the grass, and by the purging which is the consequence of the change of food §. It was upon this notion of Glisson's that Van Swieten recommended a decoction of grass and other herbs as a cure for jaundice, and several curious instances of the success attending this mode of treatment are recorded. Among others, is the case of a poor man who for two years lived by his directions almost wholly upon grass, taking it boiled in broth as his ordinary food, and drinking the decoction sweetened with honey. The patient was not only completely cured of his malady, but became so great a connoisseur in this novel diet, that he could tell which were the richest pastures by the taste of the grass. Moreover he consumed such quantities that the farmers drove him from their fields by force, so that in addition to his other calamities he was compelled to obtain it by stealth.

The brown colouring matter of the bile is almost always present in the ordinary cholesterine calculus of the human subject, but it is very rarely found in a pure state; such concretions have, however, been described by Dr. Prout in his

* Crell, *Beitrage zu den Chem. Ann.*, iv. 1, 19.

† *Ann. de Chim. et de Phys.*, xcv. 5.

‡ *Mém. d'Arcueil*, i. p. 59.

§ *De Hepate*, p. 89.

work on Diseases of the Stomach and Urinary Organs: and there are several calculi of a similar description in the Museum which were arranged by Mr. Hunter among the human biliary concretions; it is however probable that some of these were taken from the Ox.

Biliary calculi are for the most part so very impure, and, with the exception of the cholesterine calculus, so little is known of their composition, that it is exceedingly difficult to offer any arrangement of these bodies which shall be free from objection. The classification of Walther*, which was founded upon the structure and obvious characters of the calculi, was proposed at a time when chemistry had thrown no light upon their composition. Vicq d'Azyr was perhaps the first who attempted anything like a chemical arrangement. He divided them into three classes; in the first class he placed those consisting of a yellow bilious matter (*colouring matter of the bile*); in the second those composed of a brilliant crystalline matter (*cholesterine*); and the third comprehended the mixed biliary concretions, or those which contained the constituents of the two former classes†.

After the discovery of cholesterine, Fourcroy refined upon this arrangement; but his classification is very artificial, and much less useful than that of Vicq d'Azyr; it is therefore unnecessary to quote it in this place‡.

Dr. Thomson, in his recent work on Animal Chemistry, arranges biliary calculi under five classes. The first class includes those composed of pure cholesterine. The second those which likewise consist of cholesterine, but also contain the colouring matter of the bile, and some unaltered bile; the latter concretions are generally present in large numbers, and are of a polygonal figure. The third class are composed of inspissated bile, by which term must be meant the colouring matter of the bile, especially as these calculi are described as having a brown colour, and being more common in the gall-bladder of the inferior animals than in that of Man. The fourth class comprehends gall-stones which do not flame, but gradually waste away at a red heat. These are supposed to consist principally of carbon.

To these four classes must be added the concretions which consist principally of the earthy carbonates.

* *Anatomisches Museum.*

† *Recueil Périodique de la Société de Médecine.*

‡ *Op. cit.*

During the examination of this collection, two new species of biliary calculi have been discovered. One of these resembles in many particulars the ordinary calculi from the Ox, composed of the brown colouring matter of the bile, but it is distinguished from them by its want of a lamellar structure, by its black colour and by its homogeneous and resinous fracture, which give it the appearance of a mass of pitch. It also differs in not being precipitated from its potass solution in the form of green flocks. Of this species of calculus there is only one specimen in the Museum in which the peculiar matter is in a tolerably pure state, but there are several others in which it apparently exists mixed with the brown colouring matter of the bile. As this substance is closely allied to, or is perhaps some modification of the brown colouring matter of the bile, it has not been considered expedient to erect it into a separate class, or to designate it by any particular name until its properties and those of the yellow colouring matter of the bile have been more thoroughly examined. These calculi have therefore been arranged as a sub-species of the ordinary brown biliary concretion.

The other new species of calculus was found to consist of stearic and oleic acids in combination with lime.

The biliary calculi in this collection have been divided into the following classes.

Class I. Calculi consisting principally of cholesterine.

Class II. Calculi consisting principally of the brown colouring matter of the bile, or of substances allied to it, and are divided into two varieties, α and β.

Var. α consists of calculi composed of the brown colouring matter of the bile,—*Matière jaune de la Bile*, Thenard; *Gallenbraun*, Gmelin; *Beliphaein*, Simon; *Cholepyrrhine*, Berzelius. These concretions are but rarely found in the human subject, but form the ordinary gall-stone of oxen.

Var. β. Non-laminated calculi, of a black colour and having a resinous lustre. These calculi chiefly occur in the human subject, and are generally mixed with more or less of the brown colouring matter of the bile.

[illegible]

[illegible]

[illegible]

CALCULI CONSISTING PRINCIPALLY OF CHOLESTERINE.

Cholesterine forms the principal and ordinary constituent of human biliary calculi. It is sometimes found in nearly a pure state, but it usually occurs mixed with more or less of the yellow or brown colouring matter of the bile.

There are several varieties of the cholesterine calculus, which, although they resemble each other in their chemical composition, may nevertheless be distinguished by their general appearance. It may therefore be well to enumerate a few of the leading forms which this substance assumes when deposited as a solid concretion in the gall-bladder. First among these are the calculi which consist of nearly pure cholesterine. These calculi are externally of a white or light yellow colour. Their exterior is usually smooth, but sometimes distinctly crystalline. They are translucent, sometimes transparent, have a greasy feel, and acquire a waxy lustre by slight friction. When broken they present a crystalline structure, consisting of broad semitransparent plates, radiating from the centre to the circumference, and having a brilliant lustre like that of spermaceti. This variety is not very common; it frequently attains a large size and is seldom accompanied by other concretions. Vide Plate XVII.

Another variety of these concretions may be noticed, in which the gall-bladder is filled by two, three or four calculi, most commonly three. They are seldom so pure as the preceding variety: they are usually of a cylindrical figure, and are applied end to end, and have smooth articulating surfaces at the points of contact, the rounded extremity of one being often received into a cup-like depression of another. It is more common, however, to find several concretions in the gall-bladder differing considerably in size and general figure. When thus packed together in the gall-bladder they acquire a polygonal figure, and from the constant yet limited motion which that viscus is subjected to in respiration, they become polished, and acquire smooth flattened sides or faces. When several calculi are present and are nearly uniform in size, their figure is generally regular. When, on the other hand, there are but few, and these differ considerably in size, their figure is very various.

In this Collection there are several instances of many thousands of these con-

cretions taken from the same gall-bladder; the largest of the calculi not exceeding in size a millet seed. Their exterior is of various shades of colour, from pure white to brown and almost black; most commonly they are mottled with white and brown. The smaller concretions are very frequently varnished over with a layer of pure cholesterine.

The impure varieties of the cholesterine calculus when broken exhibit a considerable diversity of appearance, obviously depending upon the more or less perfect crystallization of the cholesterine, and upon the relative proportion which it bears to the colouring matter of the bile and to the other ingredients with which it is mixed. Sometimes broad plates of nearly pure cholesterine, imbedded in the yellow matter of the bile, radiate from a small nucleus of that substance. More frequently their interior consists of minute needles, which are tinged of a yellowish brown colour and have a lamellar structure. They also vary considerably in their specific gravity, but for the most part float upon water.

Biliary calculi which have passed by stool do not differ in composition from those found in the gall-bladder; they are often, however, of such a size as to render it probable that they have increased in bulk while in the intestines. That they have in the first instance been formed in the gall-bladder is shown by the absence of a nucleus of undigested food, &c., which would undoubtedly exist had their formation commenced in the intestines. No such specimen, however, exists in this Collection.

In addition to the yellow matter of the bile, cholesterine calculi almost invariably contain mucus of the gall-bladder, unaltered bile (choleate of soda), carbonate and phosphate of lime, with the soluble alkaline salts of the bile. Small quantities of the fatty acids, with traces of carbonate of magnesia, oxide of iron and silica, are also occasionally present.

Cholesterine calculi readily melt when heated, give out a peculiar resinous odour, catch fire and burn with a white smoky flame, a copious carbonaceous ash is left, containing the earthy and alkaline salts of the calculus, which, owing to the presence of carbonate of soda, may often be fused before the blowpipe. When digested in boiling alcohol, the cholesterine dissolves, while the yellow matter of the bile and mucus are left undissolved. The alcoholic solu-

tion, on cooling, deposits brilliant soft plates or spangles of pure cholesterine. If, on the other hand, the calculi are digested in a solution of potass, the colouring of the bile is removed and the cholesterine left unacted on. By the action of these reagents, together with their general appearance, the nature of these concretions may be readily determined.

Cholesterine is a peculiar body, which in appearance resembles spermaceti: it is distinguished from that substance by not being converted into a soap when boiled with an alkali, and also by requiring a temperature of 278° Fahr. for its fusion. It is tasteless, inodorous, and insoluble in water, but readily dissolves in æther, either hot or cold. Boiling alcohol freely dissolves it, but the greater part is deposited on cooling. Minute crystals of cholesterine, when examined by the microscope, are seen to consist of very thin rhombic plates. By the action of nitric acid it is converted into a crystalline acid termed cholesteric acid. Cholesterine is a natural constituent of the bile of Man, of the Ox, the Dog, and the Pig*. It also enters into the composition of the brain†, and crystals of this substance may often be observed floating in the spirit in which brains are preserved. Cholesterine is also a frequent product of disease; it has been detected in the fluids of hydrocele, ascites, and ovarian cysts; in the contents of an abscess, and in various solid and malignant tumours. According to Fromherz and Gugert, it enters into the composition of the sebaceous matter, *Vernix Caseosa*, which covers the fœtus. Cholesterine obtained from the brain is rather less fusible and dissolves more readily in alcohol than that from gall-stones; in their ultimate composition both varieties are, however, the same.

According to the analysis of Chevreul, Couerbe and Pelletier, 100 parts of cholesterine consist of—

Carbon	85·095	84·895	83·37
Hydrogen . . .	11·880	12·099	13·32
Oxygen	3·025‡	3·006§	3·31‖
	100,000	100,000	100,00

* Chevreul, Majendie, *Journ. de Phys.*, iv.

† *Ann. de Chim. et de Phys.*, lvi.

‡ Pelletier, *Ann. de Chim. et de Phys.*, li.

§ Couerbe, *Ann. de Chim. et de Phys.*, lvi.

‖ Chevreul, *Journ. de Phys.*, iv.

𝔄. *Cholesterine.*

𝔄 1. A small oval calculus, consisting of two portions: the inner is composed of cholesterine slightly tinged by the colouring matter of the bile, while the outer portion, which covers nearly the whole of the inner, is composed of perfectly pure cholesterine, transparent, and beautifully crystalline on its exterior. *Presented by J. Boutflower, Esq.*, 1843.

𝔄 2. A flattened oval calculus, broken transversely, having the following history in the Sloanian MS. Catalogue.

"A stone voided whole per anum in November 1728, by a lady about fifty years of age. She complained, some hours before it came away, of great pain in her bowels. Upon taking a glyster it came away without any blood, and she was immediately easy and well."

This calculus is composed of very pure cholesterine, apparently deposited upon a small nucleus of the colouring matter of the bile. It is made up of sparkling semi-transparent plates, radiating from the centre to the circumference of the calculus, and exhibits the crystalline structure of this species of calculus in a very characteristic manner.

British Museum, 1831.

𝔄 3. An oval calculus about the size of a nut, consisting of pure cholesterine: its exterior is highly crystalline.

Presented by Sir William Blizard, 1811.

𝔄 4. An oval calculus, measuring one inch three quarters in length by one inch and a half in diameter, which was passed per anum by a Mrs. Smart. Its centre is composed of nearly pure crystallized cholesterine, while its exterior consists of cholesterine mixed with the colouring matter of the bile. *Presented by H. P. Fuller, Esq.*, 1819.

𝔄 5. A large biliary calculus, which was passed per anum by the sister of the lady from whom the preceding calculus was voided. It resembles the former in composition, and its centre is also composed of much purer cholesterine than its exterior.

Presented by H. P. Fuller, Esq., 1819.

𝔄 6. A similar calculus, but much smaller, which was passed per anum by a woman. *Presented by William Lynn, Esq.*, 1820.

𝔄 7. A small oval calculus, consisting of nearly pure cholesterine, taken from the gall-bladder of a gentleman who died in his seventy-seventh year: there was no bile in the gall-bladder, but a small quantity of a limpid fluid. *Presented by Charles Hatchett, Esq.*, 1832.

The following four calculi are nearly similar in size and general appearance, they are composed of nearly pure cholesterine, and their external surface is crystalline.

𝔄 8.
𝔄 9.
𝔄 10.
𝔄 11. *Hunterian.*

𝔄 12. One hundred and twenty small irregularly-shaped calculi, taken from the same gall-bladder. They are composed of nearly colourless cholesterine. *Hunterian.*

𝔄 13. Numerous small calculi, similar in appearance and composition to the preceding, but rather larger. They were taken from the same gall-bladder. *Hunterian.*

𝔄 14. A large oblong calculus, consisting of cholesterine mixed in parts with the colouring matter of the bile. *Hunterian.*

𝔄 15. A small rounded calculus, consisting of nearly pure cholesterine. *Hunterian.*

𝔄 16. A nearly spherical calculus, tuberculated on its surface, consisting of almost pure cholesterine. "From the gall-bladder." *Hunterian.*

𝔄 17. A transverse section of a calculus, composed of nearly pure cholesterine. *Hunterian.*

𝔄 18. A large biliary calculus, similar in composition to the preceding. *British Museum.*

𝔄 19. Four small cholesterine calculi, having a rounded figure and tuberculated exterior. *Hunterian.*

𝔄 20. Six small spherical calculi, composed of nearly pure cholesterine, tuberculated on their exterior, and taken from the same gall-bladder. *Hunterian.*

𝔄 21. A large oblong calculus, composed of cholesterine tinged with the colouring matter of the bile. *Hunterian.*

𝔄 22. Numerous small calculi, consisting of pure cholesterine. Their figure is very irregular, and they contain so little colouring matter as to render them semitransparent. From a female who died of strangulated hernia. *Presented by Joseph Swan, Esq.*

𝔄 23. A large cylindrical calculus, truncated at each end, consisting of cholesterine mixed with the colouring matter of the bile, particularly at the exterior. *Hunterian.*

𝔄 24. A similar calculus, tinged throughout with the colouring matter of the bile. *Hunterian.*

𝔄 25. A small round calculus composed of crystallized cholesterine, tinged throughout with the colouring matter of the bile, but of a much darker colour than the preceding specimen. *Hunterian.*

𝔄 26. Two biliary calculi, each of the size of a nut. One of them is divided, and consists of nearly pure cholesterine; the exterior of the other is coated with a crust of the colouring matter of the bile, and appears to have been attacked by insects. *Hunterian.*

𝔄 27. An irregularly-shaped calculus, composed of cholesterine partially mixed with the colouring matter of the bile. *Hunterian.*

𝔄 28. Two oval calculi, composed of nearly pure cholesterine. *Presented by John Gunning, Esq.*, 1816.

𝔄 29. Two calculi, taken from the same gall-bladder, consisting of cholesterine nearly pure at the exterior, but mixed with the colouring matter of the bile at the centre. *Hunterian.*

𝔄 30. A cylindrical calculus truncated at each extremity, and another of an ir-

regular figure, taken "from Mr. Clarke." They resemble in composition the preceding specimens. *Hunterian.*

𝔄 31. A cholesterine calculus, mixed with the colouring matter of the bile. *Hunterian.*

𝔄 32. Three calculi, taken from the gall-bladder of Sir George Howard. They have smooth, mutually adapted surfaces, and are composed of nearly pure cholesterine. *Presented by Thomas Keate, Esq.*, 1811.

𝔄 33. An oval calculus, tuberculated on its exterior. Composition similar to the preceding. *Hunterian.*

𝔄 34. Four small calculi, and an elongated calculus, having a smooth flattened surface at one extremity. They are composed of cholesterine mixed with the colouring matter of the bile. *Hunterian.*

𝔄 35. Three large impure cholesterine calculi, apparently taken from the same gall-bladder, the entire cavity of which they must have filled. They have broad, mutually adapted surfaces, and when placed in contact with each other measure nearly four inches in length; their exterior is extremely rugged. *Presented by John Gunning, Esq.*, 1816.

𝔄 36. Two cholesterine calculi, each about the size of a large nut: they have smooth, mutually adapted surfaces at their extremities, and are probably from the same gall-bladder. *Presented by John Gunning, Esq.*, 1816.

𝔄 37. Two impure cholesterine calculi, taken from the same gall-bladder. One is oblong and flattened at either end; the other is angular. *Presented by Sir William Blizard*, 1811.

𝔄 38. A large oval impure cholesterine calculus, which has a smooth depression at one end from having been in contact with another calculus. *Hunterian.*

𝔄 39. A large oblong impure cholesterine calculus. *Hunterian.*

𝔄 40. A nearly similar calculus, having one of its ends flattened.

Hunterian.

𝔄 41. A biliary calculus, extracted by Sir William Blizard from a fistulous opening situated midway between the umbilicus and pubes. The following are the particulars of the case:—

"Susannah Walker, aged sixty years, was admitted into the London Hospital the 27th of March 1813, on account of a fistulous opening, situated midway of the navel and pubes, from which, she stated, had passed, some time in the last summer, within the space of a week, three stones of the appearance of chestnuts, of the size each of a small nutmeg.

"She had for nearly a year experienced pain in the abdomen, especially near the affected part, but had never suffered particularly in the region of the liver, nor had she ever been jaundiced or subject to any complaint, only had been habitually costive.

"A probe upon introduction passed freely in a sinus, obliquely to the right upwards, and at about the depth of two inches from the surface of the skin struck against a hard body, whereupon the passage was enlarged, and by it extracted a stone, apparently biliary, of the size of a small walnut, and which the woman said resembled the three stones which were discharged in the summer.

"The wound healed kindly, and in a month the patient was dismissed cured."

The central portion of this calculus consists of cholesterine mixed with the colouring matter of the bile, while the exterior is composed of nearly pure cholesterine. The smaller extremity of the calculus is concave and smooth, as if produced by contact with another stone.

Presented by Sir William Blizard, 1813.

𝔄 42. A large biliary calculus, which was voided per anum by a lady above sixty years of age. She had been subject for several years to severe paroxysms of pain in the right hypochondrium, which were always attended with vomiting, but without any febrile symptoms; these attacks usually lasted two or three hours, until relieved by large doses of laudanum; on one of these occasions aperients were administered, and after some time the

calculus was voided, from which time the patient was quite relieved from her former sufferings. She never had jaundice, nor were her evacuations at any time clay-coloured. It consists of impure cholesterine.

Presented by J. Carrick Moore, Esq., 1824.

𝔄 43. Four gall-stones and a portion of a fifth, which were passed per anum by a woman about thirty years of age. *Hunterian.*

𝔄 44. An elongated conical-shaped calculus, which has been apparently moulded in the neck of the gall-bladder. It consists of cholesterine, containing thin layers of the colouring matter of the bile.

Presented by John Gunning, Esq., 1816.

𝔄 45. A biliary calculus, about the size and figure of a small chestnut, similar in composition to the preceding specimen.

Presented by John Gunning, Esq., 1816.

𝔄 46. A large biliary calculus and the half of another, which were removed from the same gall-bladder. The larger calculus has two smooth depressions on opposite sides of one of its ends.

Presented by Sir William Blizard, 1808.

𝔄 47. Numerous small calculi, being the contents of one gall-bladder. The exterior of these calculi consists of nearly pure cholesterine, while their nucleus is mixed with the colouring matter of the bile. *Hunterian.*

𝔄 48. Several small calculi, "from the gall-bladder of a man." They are similar in composition to the former. *Hunterian.*

𝔄 49. A large cylindrical gall-stone, truncated at both ends. Cholesterine mixed with the colouring matter of the bile.

Presented by Sir William Blizard, 1811.

𝔄 50. Two small cholesterine concretions. *Hunterian.*

𝔄 51. Seven angularly-shaped cholesterine calculi. *Hunterian.*

𝔄 52. A nearly spherical calculus of a dark colour, consisting of cholesterine mixed with the colouring matter of the bile. *Hunterian.*

𝔄 53. Numerous small polygonal-shaped calculi, being the contents of one gall-bladder. Their exterior is mottled with white and various shades of brown, according as the cholesterine is pure or is mixed with the colouring matter of the bile: some of them have been deposited upon a nucleus of the latter substance. *Hunterian.*

𝔄 54. A similar series of small biliary calculi; all of them are stated to have been taken from one and the same gall-bladder, but are unaccompanied by any other history. *Hunterian.*

𝔄 55. Twenty-one small calculi, similar in composition and appearance to the foregoing. "From the gall-bladder of Lord Holderness." *Hunterian.*

𝔄 56. A small cholesterine calculus, having several flattened faces. *Hunterian.*

𝔄 57. Seven dark-coloured irregularly-shaped cholesterine calculi, taken apparently from the same bladder. *Presented by Sir Wm. Blizard,* 1811.

𝔄 58. A small oval-shaped cholesterine calculus, the exterior of which is of a dark brown colour. *Presented by Sir William Blizard,* 1811.

𝔄 59. "A gall-stone from Mrs. Collier, aged forty-seven, who had also stricture of the œsophagus, the preparation of which is in the Museum." Its exterior is tuberculated and consists of nearly pure cholesterine, while its interior contains some of the colouring matter of the bile. *Presented by Sir E. Home,* 1807.

𝔄 60. Four small white cholesterine calculi. *Hunterian.*

𝔄 61. Three small polygonal-shaped cholesterine calculi, with fragments of two others, taken from the same gall-bladder. *Hunterian.*

𝔄 62. Four small cholesterine calculi; the nucleus of one consists of the colouring matter of the bile. *Hunterian.*

𝔄 63. Three small dark-coloured cholesterine calcul, "from Mrs. Wagger, who had cancer of the uterus." *Hunterian.*

𝔄 64. Eight small polygonal-shaped cholesterine calculi, taken from the same gall-bladder. *Hunterian.*

𝔄 65. A large irregularly-shaped gall-stone, the inner and greater part of which consists of nearly pure cholesterine, while the exterior is principally composed of the colouring matter of the bile. *Hunterian.*

𝔄 66. Two small angularly-shaped cholesterine calculi. *Hunterian.*

𝔄 67. Five small angularly-shaped cholesterine calculi. *Hunterian.*

𝔄 68. Numerous small calculi, being the contents of one gall-bladder: some of them are extremely minute; they have a peculiar pearly lustre, and are composed for the most part of cholesterine. *Hunterian.*

𝔄 69. A similar series, but the calculi are much larger in size and fewer in number; they also want the pearly-looking surface. *Hunterian.*

𝔄 70. A biliary calculus about the size of a chestnut, having flattened sides, and consisting of impure cholesterine. *Leverian Museum.*

𝔄 71. A small tuberculated biliary calculus, consisting of impure cholesterine. *Presented by Sir Anthony Carlisle*, 1821.

𝔄 72. Several calculi taken from the same gall-bladder. Most of them have an angular figure, and the largest contains an entire layer of the colouring matter of the bile. *Hunterian.*

𝔄 73. Seven irregularly shaped calculi, from the same gall-bladder. They consist of nearly pure cholesterine. *Hunterian.*

𝔄 74. Several small biliary calculi, similar in composition to the preceding. *Hunterian.*

𝔄 75. Numerous small rounded tuberculated calculi, taken from the same gall-bladder. They consist of impure cholesterine. *Hunterian.*

𝔄 76. Two flattened calculi, taken from the gall-bladder of a subject in Mr. Hunter's dissecting-room. One of them has been divided; it consists of pure cholesterine deposited upon a friable brown mass, consisting almost wholly of the colouring matter of the bile. *Hunterian.*

𝕬 77. Thirty-one calculi about the size of peas, and of a polygonal figure, which were taken from the same gall-bladder. They consist of impure cholesterine. *Hunterian.*

𝕬 78. Eleven small calculi, consisting of impure cholesterine, and taken from the same gall-bladder. *Hunterian.*

𝕬 79. Four calculi similar to the preceding. *Hunterian.*

𝕬 80. An egg-shaped biliary calculus, divided transversely and measuring nearly two inches in length. It consists of impure cholesterine, and has the following history in the Sloanian MS. Catalogue:—

"A large stone voided by stool by a gentlewoman (Mrs. Anne Wright) who had been many years troubled with the colic."

British Museum.

𝕬 81. Two large calculi, consisting of impure cholesterine. One of these has been divided; it is of a cylindrical figure, and has mutually adapted surfaces at each end. It measures about one inch and a half in length by one inch across, and weighs rather more than half an ounce. The other is nearly globular, and weighs rather less than two drachms.

These calculi were expelled through a fistulous opening in the parietes of the abdomen communicating with the gall-bladder, many years before the death of the patient (the Bishop of Chichester), from whom also was taken the preparation in the Museum of a pouch in the œsophagus. The opening in the abdomen remained for a considerable time, but finally closed. The following account of the state of the parts accompanied the calculus:—

"Immediately opposite to an external cicatrix, formed by the passage through which the gall-stones had escaped, the fundus of the gall-bladder adhered closely and firmly to the peritoneum, and instead of occupying its proper situation under the liver, lay strongly stretched over its surface, the latter being greatly diminished in size. No bile was contained in the gall-bladder, but about a small tea-spoonful of fluid, both colourless and tasteless. As its duct was obliterated it would appear to have been long since a useless appendage to the system. The patient died at the advanced age of ninety." *Presented by William Guy, Esq.*, 1824.

𝔄 82. Two small cholesterine calculi.

From the collection of Dr. Wright of Lichfield.

Presented by Dr. G. Power, 1821.

𝔄 83. A cylindrical-shaped calculus, having a flattened smooth surface at each extremity, and consisting of impure cholesterine. *British Museum.*

𝔄 84. Three biliary calculi, apparently not from the same gall-bladder. One of them consists of nearly pure cholesterine surrounded by a thick crust consisting chiefly of the colouring matter of the bile. Another is composed almost wholly of the colouring matter of the bile, and has been attacked by insects ; the third is an ordinary cholesterine concretion. *Hunterian.*

𝔄 85. Two small quadrilateral calculi composed of impure cholesterine. *Hunterian.*

𝔄 86. A small impure cholesterine calculus, having several flattened sides. *Presented by Sir William Blizard.*

𝔄 87. Four small irregularly-shaped cholesterine calculi. *Hunterian.*

𝔄 88. A section of a small conical-shaped cholesterine calculus. *British Museum.*

𝔄 89. A very regularly egg-shaped calculus, above an inch in length. Its external surface is reticulated with dark lines. It is composed of impure crystalline cholesterine deposited upon a nucleus of the colouring matter of the bile. *Presented by John Gunning, Esq.*, 1816.

𝔄 90. A section of a large impure cholesterine calculus. *Hunterian.*

𝔄 91. Fragments of a flattened cholesterine calculus ; the exterior consists principally of the colouring matter of the bile. *Hunterian.*

𝔄 92. Three dark-coloured calculi, composed of impure cholesterine. From the same gall-bladder. *Presented by Everard Home, Esq.*, 1807.

𝔄 93. A few small cholesterine calculi.

"Lapilli e vesicula bilis humana."—*Sloanian MS. Catalogue.*

British Museum.

𝕬 94. An oblong cholesterine calculus, having a rough external coat composed principally of the colouring matter of the bile.

"This calculus was voided per anum by Phillip Thicknesse, Esq., in 1768, after suffering considerable pain: several smaller concretions had been passed about ten years previous."

Presented by Everard Home, Esq., 1808.

𝕬 95. A considerable number of small cholesterine calculi, having the following history in the Sloanian MS. Catalogue:—"The gall-bladder of Dr. Walter Charlton, full of angular gall-stones. The end of it was joined to the peritoneum, from whence gall was discharged by a tumour which turned to an ulcer in the side. From Mr. Cowper."

British Museum.

𝕬 96. Several small cholesterine calculi, apparently taken from the same gall-bladder. *British Museum.*

𝕬 97. Three impure cholesterine calculi. *Hunterian.*

𝕬 98. Three calculi similar to the preceding, but larger.

Presented by J. Gunning, Esq., 1816.

𝕬 99. Four cholesterine calculi, apparently taken from the same gall-bladder. Two of them are united together; all of them have flattened surfaces.

British Museum.

𝕬 100. An elongated oval calculus which was expelled through an abscess in the parietes of the abdomen. It measures rather more than two inches in length by one inch across, and is composed of concentric layers of cholesterine, mixed uniformly with the colouring matter of the bile, surrounding a nucleus of nearly pure cholesterine.

Presented by John Abernethy, Esq., 1824.

𝕬 101. A small biliary calculus, the exterior of which is composed of carbonate of lime; it has a dark brown colour, and is deeply grooved like the surface of some Madrepores. The inner and larger portion of the calculus consists of cholesterine tinged with the colouring matter of the bile.

Presented by Sir William Blizard, 1809.

𝔄 102. An impure cholesterine calculus, the external surface of which consists of carbonate of lime, and is of a dark brown colour.

" From a patient of the name of Laird."

Presented by Everard Home, Esq., 1807.

𝔄 103. A large oblong calculus, broken transversely, which was accompanied by the following history :—" Ann Aldred, æt. 71, had violent pains in her sides during a period of three months, at the termination of which she evacuated a gall-stone per anum with considerable difficulty unaccompanied by fæces. Immediate cessation of pain ensued, and four months have now elapsed without any return of her complaints."

This calculus consists of nearly pure cholesterine, deposited upon a small nucleus of the colouring matter of the bile, mixed with a large proportion of carbonate of lime and a little cholesterine : the nucleus is loose and has been divided.

Presented by Sir William Blizard, 1822.

𝔄 104. A large oval calculus consisting of cholesterine mixed, especially at its exterior, with the colouring matter of the bile. *Hunterian.*

𝔄 105. Numerous small polygonal-shaped calculi consisting of impure cholesterine taken from one gall-bladder. *Hunterian.*

𝔄 106. A similar series. *Hunterian.*

𝔄 107. A similar series. *Hunterian.*

𝔄 108. A small broken calculus consisting of nearly pure cholesterine surrounding a dark-coloured friable nucleus composed chiefly of the colouring matter of the bile. *Hunterian.*

𝔄 109. A small oval gall-stone broken across ; it consists of crystallized cholesterine. *Hunterian.*

𝔄 110. Five small dark-coloured calculi composed of impure cholesterine. *Hunterian.*

𝔄 111. A biliary calculus the surface of which is crystalline ; it consists of nearly pure cholesterine. *Hunterian.*

𝔄 112. Two small angularly-shaped biliary calculi consisting of impure cholesterine deeply stained by the colouring matter of the bile. *British Museum.*

𝔄 113. Four small "human gall-stones," consisting of impure cholesterine coated by the colouring matter of the bile, with some carbonate of lime.
Presented by Everard Home, Esq., 1807.

𝔄 114. A large cylindrical calculus consisting of cholesterine and the colouring matter of the bile. Taken from the gall-bladder of an old woman.
Presented by J. D. Hudson, Esq., 1842.

𝔄 115. A section of a small cylindrical calculus composed of impure cholesterine. *Presented by W. T. Brande, Esq.*, 1841.

𝔄 116. Fragments of three small impure cholesterine calculi.
Presented by Sir William Blizard, 1822.

𝔄 117. A large oval calculus tuberculated on its exterior, consisting of nearly pure cholesterine. *Mus. Taunton.*

𝔄 118. A small cholesterine calculus. *Hunterian.*

𝔄 119. A tuberculated cholesterine calculus. *Hunterian.*

𝔄 120. Seven irregularly-shaped cholesterine concretions taken from the gall-bladder of an old woman, whose liver and lungs were studded with deposits of a yellow matter resembling gelatinous carcinoma. The glands in the mesentery and in the posterior mediastinum were converted into the same carcinomatous-looking matter, and the former constituted a large tumour on the right side of the abdomen; a similar deposit had also taken place in the submucous tissue of the gall-bladder. The patient suffered from pyrosis for the last thirty years of her life, and a recent ulcer, together with the cicatrices of several others, were visible on the internal lining of the stomach. Her appetite was good, and the evacuations were natural. Some years before death a tumour was removed from the front of the tibia, which was pronounced to be true cancer.

The gall-bladder contained a small quantity of a sero-purulent fluid, apparently unmixed with bile; it is preserved, with a portion of the liver, among the pathological preparations.
Presented by Thomas Taylor, Esq., 1843.

𝔄 121. Seven small cholesterine calculi, having the following memorandum in

the Sloanian MS. Catalogue :—" Calculi 120 ex vesicâ felleâ Equitis Roberti Jawdie de Claxton desumpti præter 30 aut 40 deperditos 1638. Item calculi fellei duo per sedem ejecti a Dominâ Holt de Tharton quæ postea a sæpius recurrente ictero convaluit 1648.—Sir Thomas Brown."
British Museum.

𝔄 122. A small oval calculus, composed of cholesterine slightly tinged with the colouring matter of the bile. *Hunterian.*

𝔄 123. Fragments and the powder of "a cluster of four gall-stones taken from a lady :" these concretions appear to have contained some animal matter, perhaps inspissated bile, which has been devoured by Dermestes, causing them to fall to pieces. They consist of cholesterine mixed with a very large proportion of the colouring matter of the bile.
Presented by Everard Home, Esq., 1807.

𝔄 124. A large biliary calculus, the exterior of which has fallen to pieces; it was accompanied by the following history :—" Lawrence, Sexagenaria. Post enormes vomitus fœtidissimos (quos sæpe antea experta fuerat) et acutas dolores lateris, hic calculus exiit cum fæcibus 5 Dec. 1785, â omnium symptomatum fugâ, excepta quædam hypochondrii indolescentia, et tum pendebat ʒi gr. xxiiiss." *Presented by Everard Home, Esq.*

𝔄 125. Seven polygonal-shaped calculi, consisting of impure cholesterine, taken from one gall-bladder. *Hunterian.*

𝔄 126.
𝔄 127.
𝔄 128. Gall-bladders containing biliary concretions. *Hunterian.*
𝔄 129.
𝔄 130.

𝔄 131. A gall-bladder the cavity of which is almost entirely filled by a large cholesterine calculus. *Hunterian.*

𝔄 132. Three cholesterine calculi, which fill the entire cavity of a gall-bladder. They have been divided and are held together by the dried bladder.
Presented by Dr. J. Power, 1821.

𝔄 133. A gall-bladder completely filled by four or five of the ordinary cholesterine concretions. *Mus. Howship.*

CALCULI CONSISTING PRINCIPALLY OF THE COLOURING MATTER OF THE BILE, CHOLEPYRRHINE (*Berzelius*), OR OF SUBSTANCES ALLIED TO IT.

It has been already remarked that the colouring matter of the bile very rarely forms an entire calculus in the human gall-bladder, although it is generally present in cholesterine calculi. The following calculi, though probably many of them were taken from the Ox, were arranged by Mr. Hunter among the human concretions, in which place they are retained, as similar concretions have been examined by Dr. Prout which were undoubtedly of human origin. In their chemical and general characters these concretions differ in no respect from those found in the gall-bladder of oxen; their description will therefore be included in the preface to the catalogue of the biliary concretions from the lower animals.

𝔅. *Var. α. Colouring Matter of the Bile.*

𝔅 α 1. Three small angularly-shaped biliary calculi with two broken masses of the same. They are composed of concentric laminæ of the colouring matter of the bile, mixed with mucus of the gall-bladder, a little inspissated bile and a trace of fatty matter, but they do not contain any cholesterine. *Hunterian.*

𝔅 α 2. Three similar calculi having a tetrahedric figure. *Hunterian.*

𝔅 α 3. Several oval and angularly-shaped calculi, composed almost wholly of the colouring matter of the bile. *Hunterian.*

𝔅 α 4. Fragments of three angularly-shaped calculi similar in composition to the preceding. *Hunterian.*

𝔅 α 5. Fragments of a similar calculus, stated to have been taken from the human gall-bladder. *British Museum.*

𝔅 α 6. Several broken calculi, composed almost entirely of the colouring matter of the bile. *Hunterian.*

𝔅 α 7. A large oval calculus consisting of the brown colouring matter of the bile. *Hunterian.*

𝔅 α 8. An oval calculus, having an angular surface; similar in composition to the preceding. *Hunterian.*

𝔅. *Var. β. Substance allied to the Colouring Matter of the Bile.*

The concretions included in this variety, although possessing the general chemical characters of the colouring matter of the bile, yet differ from it in so many particulars, that they must be regarded as containing a peculiar substance, the existence of which has not been hitherto noticed; only in Nos. 1 and 2 of the following calculi does this substance occur in a state of tolerable purity, in all the others it is mixed with the colouring matter of the bile. These concretions are not very uncommon in the human subject; they have not been found in the lower animals, and are probably identical with those frequently described as consisting of inspissated bile. They are distinguished in their external characters from calculi composed of the colouring matter of the bile by their deep black colour and shining lustre, by not being made up of concentric layers, but consisting of a homogeneous mass resembling in lustre, fracture, &c., a mass of pitch. They usually assume the form of small wrinkled grains, but are sometimes found of an oval figure with a rough external surface. (Vide Plate XVII. fig. 9.)

These calculi dissolve for the most part in solution of potass; the solution is of a brownish-red colour: muriatic acid throws down from it a dirty brown flocculent precipitate, which dissolves in solution of ammonia with a pinkish-red tint, and is again precipitated on the addition of an acid; when muriate of baryta is added to the ammoniacal solution a light brown precipitate falls. When heated on platina foil they emit an offensive odour; do not fuse, but catch fire, burn for a short time, and leave an abundant carbonaceous ash, which frequently contains the carbonates of lime and soda. The greater part of the lime is in chemical combination with the organic matter, as the calculus only partially dissolves in solution of potass, unless previously digested in an acid, when the lime is removed and the residue wholly dissolves in the alkaline liquor. They are insoluble in water, and very sparingly so in alcohol, æther and solution of ammonia.

B β 1. A broken biliary calculus the exterior of which is of a dark colour and very rough. It consists principally of the peculiar colouring matter above described, and contains carbonate of lime with the mucus of the gall-bladder. The nucleus does not fill the entire cavity of the calculus; it is of a deep black colour with a resinous lustre and fracture; its composition is similar to the exterior, and resembles a small mass of pitch. *Hunterian.*

B β 2. Several small irregularly-shaped masses of biliary concrete. They possess a black colour with a resinous lustre, and are similar in composition to the preceding. *Hunterian.*

B β 3. Several small irregularly-shaped masses of biliary concrete of a black colour, and having a resinous lustre. Composition similar to the preceding. *Hunterian.*

B β 4. Four irregularly-shaped calculi, resembling Cannel-coal in fracture and colour. Composition similar to the preceding. *Hunterian.*

B β 5. Several small round biliary calculi, of a dark brown, almost a black colour. They consist of the peculiar matter above described mixed with the brown colouring matter of the bile. *Hunterian.*

B β 6. A small mulberry-shaped calculus, taken from the gall-bladder of a seaman who was executed for murder. It is of a very dark colour, but not so shining as the specimens Nos. 1 and 2, and it contains in addition to their constituents a considerable proportion of the brown colouring matter of the bile. *Presented by William Clift, Esq.*, 1816.

B β 7. Biliary concrete in the form of small grains. Composition similar to No. 5. *Hunterian.*

B β 8. Small fragments of biliary concrete, apparently similar in composition to the former. *Hunterian.*

B β 9. The same. *Hunterian.*

B β 10. Fragments of biliary calculi, consisting of the same black matter mixed

with a large quantity of the brown colouring matter of the bile, carbonate of soda and earthy matter. *Hunterian.*

𝕭 β 11. A similar specimen. *Hunterian.*

𝕭 β 12. Several small wrinkled calculi of a deep black colour. They are composed of the peculiar matter above described mixed with the brown colouring matter of the bile, lime and mucus of the gall-bladder. *Mus. Howship.*

CALCULI CONSISTING PRINCIPALLY OF THE FATTY ACIDS (STEARIC, OLEIC OR MARGARIC ACID).

In the bile of most species of animals, small quantities of oleic, margaric and stearic acids are to be found in combination with soda. The only instance, however, of these acids forming a biliary concretion, was discovered in this collection in a calculus which was placed by Mr. Hunter among the human urinary concretions, and was supposed to consist of the earthy phosphates. It was unaccompanied by any history, and it must therefore remain doubtful whether it was taken from the human subject or from one of the lower animals. As the fatty acids, however, in their ultimate composition bear a much greater analogy to cholesterine, the principal constituent of human concretions, than they do to the colouring matter of the bile, and as biliary calculi, with the exception of those from oxen, are very uncommon in the lower animals, this calculus is allowed to remain with the human concretions.

This calculus was of a dirty white colour, and had the greasy feel of cholesterine calculi; it floated on water, and when applied to the tongue, left an impression of bitterness. It was of an oval figure slightly flattened, one inch and a half in length, rather better than an inch in thickness, and about one inch and a quarter in breadth. It readily yielded to the knife, and the cut surface presented a polished appearance; its structure was lamellar, being composed of white and reddish-yellow layers arranged concentrically and alternating with each other. The layers were easily separable: at its centre there was a small vacuity.

When heated before the blowpipe it readily fused, then caught fire, burning

with a clear flame and giving out the smell of animal matter, but nothing of a urinous character. It left a carbonaceous residue, which by raising the heat was converted into a white ash. This ash was alkaline, dissolved in water and dilute acetic acid, and the solutions gave a white precipitate with oxalate of ammonia; it was therefore lime.

When digested in boiling water, the water became slightly brown, and on evaporation a transparent yellowish-brown residue was left, which had a bitter taste and consisted of inspissated bile.

Boiling alcohol extracted from it only a minute quantity of white fatty matter, which was deposited on cooling.

A solution of caustic potass removed the whole of the colouring matter, but the rest of the calculus was unacted on: the potass solution was dirty green, and when neutralized with muriatic acid deposited a scanty precipitate having the same tint.

When digested in nitric acid, effervescence took place, with the escape of a little nitrous acid; it then melted into a transparent oil, which on cooling concreted into a white fatty matter. This substance, when washed with distilled water, melted at a temperature much below that of boiling water.

When, instead of nitric acid, muriatic or acetic acid was employed, the portion of calculus did not melt until it had been removed from the acid; it then presented similar appearances to that obtained by the action of nitric acid; consequently this white fatty matter was not formed by the action of the nitric acid.

In all these cases the acids retained lime in solution. The fatty matter separated by the action of acids was partially soluble in boiling alcohol, and the solution on cooling deposited shining crystalline scales. With caustic potass it formed a ropy almost gelatinous solution, and was precipitated in white flakes on the addition of an acid. A small piece being placed upon the ball of a thermometer previously heated, began to solidify when the temperature had sunk to about 135° Fahr.

From these experiments there could be no doubt that this calculus consisted of margarate, or stearate of lime, mixed probably with the oleate of the same base and some of the other constituents of the bile. That the lime was in combination with the fatty acid, was indicated by the insolubility of the calculus either

in alcohol or caustic alkaline solutions, until it had been previously digested in an acid.

To determine whether one or more of the fatty acids were present, the following analysis was made.

12·80 grs. of the calculus previously dried *in vacuo* over sulphuric acid were boiled in distilled water: a peculiar odour was given off, and the water acquired a yellowish-brown colour: being evaporated to dryness it left a transparent resinous-looking residue, which weighed 0·84. This residue when digested in alcohol left 0·24 in the form of dirty yellow flakes, which in distilled water swelled up and ultimately dissolved, forming an imperfect solution which in its chemical characters exactly resembled that of the mucus of the gall-bladder.

The alcoholic solution being evaporated to dryness, the residue was redissolved in water; the solution was intensely bitter; with muriatic acid it gave a copious viscid precipitate; acetate of lead produced likewise a viscid precipitate, and the supernatant liquor when clear was again troubled by a solution of subacetate of lead.

The 0·84 consisted therefore of mucus of the gall-bladder 0·24; inspissated bile 0·60.

After water had extracted from the calculus all that it was capable of dissolving, it was treated with successive portions of boiling alcohol sp. gr. ·830.

The first alcoholic solution on cooling deposited a white matter, which did not readily redissolve in hot alcohol or æther, but was acted upon by acetic acid. It appeared to be part of the calculus that had been dissolved unchanged; the quantity was however too minute to be estimated. The alcoholic solutions were filtered, and being mixed together, the whole was gently evaporated; as the liquid became concentrated, it deposited some white fatty matter and acquired a yellow tinge; a residuum was ultimately left, which had the appearance of a mixture of a fluid and a concrete oleaginous substance. On the application of heat it became a yellow oil, which on cooling only partially solidified; it weighed 0·47. This matter strongly reddened litmus paper; dissolved readily in a cold solution of caustic potass; and was precipitated in soft flakes on the addition of an acid. It consisted therefore of oleic acid, mixed with margaric or stearic acid.

Strong acetic acid diluted with twice its bulk of water was now poured over

the calculus, and the action of the acid aided by a gentle heat. The insoluble residue was collected on double filters, washed, and dried.

The acetic solution with its washings was reduced to a small bulk, and a solution of ammonia added; after the lapse of several hours no precipitate appearing, the excess of ammonia was nearly neutralized by a solution of oxalic acid: a white precipitate fell, which when washed, dried, and heated to dull redness in a platina crucible, left 2·09 carbonate of lime = 1·17 lime.

The remaining liquid being evaporated to dryness and the ammoniacal salts expelled, a residuum was left which weighed 0·10: water dissolved a portion of this; the solution was alkaline, and when evaporated minute crystals were formed, which slightly effervesced in acetic acid: their solution not precipitating chloride of platina, leaves little doubt of their being carbonate of soda: the small portion which remained undissolved proved to be carbonate of lime.

The matter left upon the filter after the action of the acetic acid was again digested in boiling alcohol, a considerable portion dissolved, and the remainder had acquired a much deeper colour: it was collected on the same filters, which were repeatedly washed with boiling spirit; when dried and weighed it amounted to 0·86.

This substance possessed a brownish-yellow colour. It dissolved in solutions of caustic and carbonate of potass, forming solutions having nearly the same tint.

Muriatic acid rendered it green, and when added to its alkaline solution threw down green flocks.

With nitric acid it formed a red solution.

This substance was therefore identical with the colouring matter of the bile.

The alcoholic solutions were concentrated by careful distillation in a small retort: the liquid remaining in the retort, when cold, formed a soft crystalline mass, composed of brilliant plates and having a pearly lustre, very much resembling margaric acid.

The crystalline matter, when fused and kept for some time *in vacuo* over sulphuric acid, weighed 8·88. It melted at 136° Fahr., and on cooling became a crystalline solid, which reddened litmus paper, and was easily soluble in a cold solution of caustic potass; the solution when concentrated was ropy and gelatinous; when dilute it formed a slightly milky mixture with minute glistening particles

floating in it; on the addition of an acid, the substance was thrown down in the form of white flakes, which possessed the same properties as before solution. When boiled with the alkaline carbonates, it was dissolved, with the escape of carbonic acid. By redissolving it in hot alcohol, crystalline plates were deposited on cooling, which after washing with cold spirit fused at about 140°. The low fusing-point of this substance evidently indicated the presence of oleic acid. In order to ascertain whether the crystals fusible at 140° were pure margaric acid or stearic acid rendered more fusible by an admixture of oleic acid, they were again dissolved in warm spirit, and the crystals as soon as formed dried by compression between folds of blotting-paper; by repeating this process two or three times, the fusing-point was raised to nearly 160°. These crystals must therefore be regarded as pure stearic acid; and as it was found that both stearic and margaric acids require to be several times recrystallized from their alcoholic solutions to free them from even small quantities of oleic acid, and as no decided indication of the presence of margaric acid could be detected in the mother liquors, it is probable that only oleic acid had been separated by the above treatment, and that consequently margaric acid did not enter into the composition of the calculus. It would however be impossible to speak decidedly on this point.

The result of the analysis is as follows:—

Stearic acid mixed with a small proportion of oleic acid .	9·35
Lime	1·17
Soda with a trace of lime	0·05
Yellow colouring matter of the bile	0·86
Inspissated bile	0·60
Mucus of the gall-bladder	0·24
	12·27
Loss	53*
	12·80

C. *Stearate and Oleate of Lime*

C 1. A section of the biliary calculus, the analysis of which is given above. (Vide Plate XVII. fig. 1.)

* The greater part of the loss in this analysis should be added to the stearic acid, as owing to the sudden extrication of vapour while under the receiver of the air-pump a small part of the acid was thrown out.

CALCULI CONSISTING PRINCIPALLY OF CARBONATE OF LIME.

Carbonate of lime is very frequently found in small quantities in biliary concretions. The most remarkable and probably the first instance of this salt forming an entire biliary calculus, was described by Dr. Marcet in his 'Essay on Calculous Disorders.' This concretion consisted wholly of carbonate of lime tinged by bile. It was of a bright yellow colour, heavier than water, and measured $2\frac{5}{8}$ inches in length and $2\frac{1}{4}$ inches in its largest circumference. It was taken by Mr. Green from the gall-bladder of a body in the dissecting-room of St. Thomas's Hospital.

MM. Bally and Henry* also found a gall-stone from the human subject to consist of 72·70 per cent. of carbonate of lime, with a trace of carbonate of magnesia, and 13·51 of phosphate of lime.

D. *Carbonate of Lime.*

D 1. A small oval calculus of a dark brown colour divided transversely. This calculus contains nearly 70 per cent. of carbonate of lime, with a trace of phosphate of lime and carbonate of magnesia; the remainder consists of the brown colouring matter of the bile. (Vide Plate XVII. fig. 13.) *Hunterian.*

D 2. Eight small concretions consisting of carbonate of lime, deposited upon a nucleus of the colouring matter of the bile. "From the human gall-bladder." *Hunterian.*

FROM THE SALIVARY ORGANS.

CALCULI CONSISTING OF PHOSPHATE, WITH CARBONATE OF LIME.

The concretions which form in the salivary glands and passages are similar in composition to those from the prostate gland, being always composed of phosphate of lime, mixed with variable quantities of carbonate of lime and animal matter. With the exception of containing a greater number of epithelial scales, their animal matter when examined by the microscope presents similar appearances to that of urinary calculi. Salivary calculi seldom possess a regularly

* Simon, *Handbuch der Medizinischen Chemie*, ii. p. 569.

laminated structure; they are of a white colour, and extremely hard; their external surface is usually rough, sometimes tuberculated; when heated before the blowpipe they char, and emit a very fœtid odour of burning animal matter. The composition of these concretions was first pointed out by Dr. Wollaston. A specimen analysed by Lecanu gave phosphate of lime 75, carbonate of lime 20, animal matter and loss 5*.

𝔊. *Phosphate, with Carbonate of Lime.*

𝔊 1. A submaxillary calculus, composed of phosphate of lime with a trace of carbonate of lime and animal matter. This calculus was described in the Sloanian MS. Catalogue as "an oblong rugged stone, taken out of the ranula under the right side of the tongue of Foulk Williams. There was some part cutt to make way: it was extreme fetid: had been twelve years breeding: some pain at first coming." *British Museum.*

𝔊 2. A small calculus, "from Mr. Chauney."—Sloanian MS. Catalogue. It consists principally of phosphate of lime, and has probably been taken from one of the salivary ducts. *British Museum.*

𝔊 3. An oval-shaped concretion, similar in composition to the preceding specimens. "From the duct of the maxillary gland." *Hunterian.*

𝔊 4. A large submaxillary calculus of a flattened pyriform figure. It measures one inch and a half in length and three quarters of an inch in breadth. "Formed under the tongue of Richard Dyche. He was a very old man, and was conceived to be dying, being nearly choaked by the tumour, when in consequence of an effort the calculus was thrown out, and he recovered." Phosphate with a little carbonate of lime and animal matter. *Presented by James Moore, Esq.*

𝔊 5. A small submaxillary concretion, divided transversely. Described in the Sloanian MS. Catalogue as "a stone from the tongue, and which occasioned a quincy to a coachman in Great Russell Street." Phosphate of lime. *British Museum.*

𝔊 6. A small oblong calculus, consisting principally of phosphate of lime. "From the sublingual gland: formed in twelve days." *Hunterian.*

* *Journ. de Pharm.*, xiii. 626.

[illegible] Fragments of a [illegible] concretion taken from the [illegible] of a [illegible] years of age.

Presented by James Briggs, Esq. [illegible]

[illegible] concretion, consisting chiefly of phosphate of lime. [illegible]

Hunterian.

FROM THE STOMACH AND INTESTINES.

INTRODUCTION.

Intestinal concretions are of rare occurrence in the human subject, and owe their formation to accidental circumstances; the greater number of them being composed mainly of substances which have been received with the food into the alimentary canal. The crystalline phosphates of magnesia and lime, which form the most common species of intestinal calculus from the lower animals, scarcely, if ever, constitute an entire calculus in the human intestine, although these earthy salts are generally present in the oat-hair concretions. Indeed, the only kind of intestinal concretion to which man can be said to be liable is the oat-hair concretion described by Dr. Wollaston, and this only occurs in persons who live chiefly upon undressed oatmeal.

Fatty concretions have been described by MM. Lassaigne*, Colombot and Caventou as occurring in the human subject. Those examined by the last-named chemist were translucent and of a light green colour. They readily dissolved in alcohol, but left behind an animal matter consisting of thin vesicles in which the fatty matter had been contained†. In this Museum there are three small calculi possessing similar characters. Their exterior consists of a thick brown membranous coat; internally they are soft, and have the appearance of [illegible] fat. When digested in alcohol the fatty matter dissolved, and the insoluble residue, examined by the microscope, was seen to consist of transparent vesicles precisely similar to those of adipose tissue. It is therefore probable that they were nothing more than rolled masses of undigested fat.

Among other substances have been met with in the human intestines, in

* [illegible]   † Journ. de Pharm. xv. 72.

some instances causing death by the obstruction they offered; these can however be scarcely termed calculi, since they are merely amorphous masses of various ingesta, which the bowel, from weakness or disease, has been unable to expel. Such are the masses of carbonate of magnesia described by Mr. Brande as being found in the colon of a lady who had taken large quantities of magnesia.

The human intestinal concretions are divided into the following classes. The figures indicate the number of specimens belonging to each variety at present in the Museum.

𝔥.	Calculi consisting principally of animal hairs	1.
𝔍.	. . . . vegetable hairs	18.
𝔎.	. . . . various amorphous substances	2.

CONCRETIONS CONSISTING OF ANIMAL HAIRS.

𝔥. *Hair-balls.*

𝔥 1. Three balls of human hair. The smallest was voided per anum. The two larger were taken from the stomach. The following history of the case, by William Wood, Esq., is abridged from the eighth volume of 'Medical Facts and Observations.' Mary Spain, aged 22, enjoyed good health until 18 years of age, when she became chlorotic; had frequent vomiting, constipation, and pains in the abdomen resembling labour pains. These symptoms returned every three or four months. About three weeks before her death, she voided a small mass of hair. On opening the abdomen two large masses of hair were found in the stomach, and a quantity of dark-coloured fluid in the peritonæum. The hair weighed when dry above ten ounces and a half; it resembled that on her head, which her friends had remarked had become of late very short, although no one had ever seen her swallow any*. *Mus. Heaviside.*

CONCRETIONS CONSISTING PRINCIPALLY OF VEGETABLE HAIRS.

The concretions found in the large intestines of the human subject are generally composed of the small hairs which are attached to the summit of the

* A similar case occurring in a boy is recorded in the London Medical Journal, vol. iv. p. 361.

oat-seed (*Avena sativa*). They are not, however, of very common occurrence, being for the most part confined to the labouring classes of Scotland and some of the northern counties of England, where oatmeal forms a large portion of their daily food.

These concretions are irregular in form and size. They are frequently as large as the fist, and are of a dirty-white or light brown colour. Their external surface is smooth, and they are exceedingly light. When divided they are found to consist of concentric layers of a fibrous substance closely felted together having a velvety feel, between which are often to be observed thin white layers consisting of the earthy phosphates. A piece of bone, a plum- or cherry-stone usually constitutes their nucleus.

Dr. Monro, whose father had made a large collection of these calculi, has given an elaborate history of them in his 'Morbid Anatomy of the Gullet.' We are informed by him that they were considered by Morgagni as similar in composition to biliary concretions, while others, as Van Swieten, Richerand and Callisen, were of opinion that they consisted simply of indurated fæces. These calculi were analysed by Cadet without success, and also by Dr. Thomson, who detected in them small quantities of various saline and earthy substances, but was unable to determine the nature of the vegetable matter which constituted the bulk of the calculus and gave to it its peculiar characters. Their composition remained unexplained until one of the concretions was shown to Dr. Wollaston, who "found the velvety substance to consist of extremely minute vegetable fibres or short needles pointed at both ends, which he immediately conjectured to arise from some kind of food peculiar to Scotland. For some time however he failed in his attempts to trace this substance to its origin. But the ingenious Mr. Clift, of the College of Surgeons, to whom the subject was mentioned in conversation, having put the question, whether this fibrous substance might not proceed from oats, Dr. Wollaston was induced to examine the structure of this seed, and the result fully verified Mr. Clift's conjecture. If the oat-seed be denuded of its husk, minute needles or beards forming a small brush are seen planted at one of its ends. Dr. Wollaston, on examining these needles and comparing them with similar ones detached from the calculi and forming the velvety substance in question, satisfied himself of their perfect identity*."

* Marcet's Essay on Calculous Disorders, 1819, p. 139.

Since this discovery by Dr. Wollaston, the oat-hair calculus has been examined by Mr. Children and by many other chemists, also lately by Dr. D. Maclagan, whose analysis is subjoined, as it furnishes a good example of the various substances which enter into the composition of these concretions*. Among the vegetable hairs which constituted the fibrous matter of the calculus, Dr. Maclagan detected portions of the paleæ, and other parts of the husk of the seed. The oat-seed and its hairs magnified, together with a figure of one of the calculi, is given in Plate XVI. fig. 6.

𝔍. *Oat-hair Concretions.*

𝔍 1. Three large irregularly-shaped concretions and a portion of a fourth, consisting of the setæ on the oat-seed, with layers of the earthy phosphates.

An account of this case with an analysis of the concretions is published by Mr. Children in the Transactions of the Royal Society for 1822, from which the following has been abridged. John Chambers, aged 19, a carpenter at Clitheroe in Lancashire, was in the habit, during the hot weather of July 1814, of eating a quantity of unripe plums, usually swallowing the stones at the same time, under the notion entertained by the lower classes in that neighbourhood that they would assist the digestion of the fruit. About eight months afterwards he applied to Mr. Coultate for advice, complaining of pain in the abdomen attended with diarrhœa. His abdomen was found to be tense, but not much enlarged. When in the workshop he used to lean against the bench, pressing his stomach hard against it, which he said afforded him great relief; medicines of an astringent nature were first prescribed, which seemed for a time to be of service, but the diarrhœa increased, with emaciation, and a hard circumscribed tumour was discovered on one side of the abdomen. The patient daily became more emaciated, and in about three months he died. His appetite was voracious, to within a short time of his death. He always felt himself worse after meals. His stools, especially for some weeks before he expired, were like blood and water.

* Water 10, albumen 2, fæcal matter 6, soluble vegetable matter 8, lactate of soda 2, salts, muriates and sulphates 2, fatty matter and stearic acid 8, phosphate of lime with traces of sulphate 20, fibrous matter 36, silica 6. London and Edinburgh Monthly Journal, 1841, p. 646.

On opening the body, the three concretions were found in the arch of the colon, closely compacted together. The coats of the intestine were much thickened, and formed into a sort of pouch, where the concretions lay. The other viscera were healthy. One of the concretions was divided and found to contain a plum-stone.

Chambers's usual diet was milk porridge twice a day, viz. at breakfast and supper; the milk thickened with oatmeal. His dinner commonly consisted of meat and potatoes, with oat-cake. In the afternoon he ate oat-bread and cheese, so that he never took a repast without oatmeal in some form.

The largest of these calculi weighed 1036 grs.; the smallest rather more than 511 grs. The specific gravity of the largest was 1·875 at 60° Fahr.

By the successive action of cold and hot water, alcohol, a dilute solution of caustic soda and of muriatic acid, Mr. Children found a hundred grains of one of these concretions to consist of—

Animal matter, chiefly gelatine	25·20
Resin	3·90
Phosphate of magnesia and ammonia	5·16
Phosphate of lime	45·34
Vegetable fibre	20·30
	99·90

𝔍 2. Two large irregularly-shaped oat-hair concretions, having the following history in the Sloanian MS. Catalogue:—"Taken from the rectum of a woman at Romford, the history of which is given by George Thompson, M.D., in the appendix to a book called 'Galenopale,' printed in London, 1665, 8vo. Litho Colon." Each of these specimens is made up of two concretions cemented together by an external crust, consisting of the carbonates of lime and magnesia. *British Museum.*

𝔍 3. A similar specimen divided longitudinally, having apparently a small seed for its nucleus; it was extracted from the rectum of a young man 26 years of age by Dr. Webster, in 1783: the patient had voided before several smaller concretions of a similar character.

Presented by Dr. Babington, 1822.

ℨ 4. Three oat-hair concretions, which were extracted from the rectum of a boy in Lancashire by Mr. Barlow.
Presented by — Barlow, Esq., 1821.

ℨ 5. Three similar concretions, extracted by Mr. Barlow from the rectum of a girl. The setæ of the oat, of which they are principally composed, have accumulated around plum-stones, and they are coated in parts by a white crust, consisting of phosphate of lime with a little phosphate of magnesia and ammonia. *Presented by — Barlow, Esq.*, 1821.

ℨ 6. An intestinal concretion, similar in composition to the preceding, divided longitudinally. *Presented by Sir A. Cooper*, 1821.

ℨ 7. "A ball or bezoar taken out of the guts of a schoolmaster in Lancashire, who suffered seven years of the colic by it (notwithstanding the attempts of physicians). The centre is a plumb-stone stuck there, which gathered *tomentum* about it, which was found in opening his body, by his own direction, after death, to find out the cause of so great a distemper. Bought of Dr. Leigh."—*Sloanian MS. Catalogue.* It is one of the ordinary oat-hair concretions. *British Museum*, 1821.

ℨ 8. An oat-hair concretion of a nearly spherical shape, measuring two inches in diameter. "This stone was extracted in 1717 from the rectum of a Cumberland labourer; he had been puny and consumptive for five or six years previously, but after its extraction he became strong, fleshy and well." Its nucleus is a plum-stone, and it is coated by a thin earthy crust. *British Museum.*

ℨ 9. A small intestinal concretion from the human subject, having a plum-stone for its nucleus. *British Museum.*

ℨ 10. A similar specimen, being "one of many balls found in the intestinum ileum of a man in St. Bartholomew's Hospital, who was thought to have the stone. From Mr. Dobbins."—*Sloanian MS. Catalogue.*
British Museum.

ℨ 11. Human intestinal concretion, composed of the setæ on the oat-seed. It has a plum-stone for its nucleus. *British Museum.*

ℑ 12. A globular intestinal concretion, similar in composition to the preceding specimen, but coated by a thin crust, consisting principally of phosphate of lime. *British Museum.*

ℑ 13. A large and very irregularly-shaped concretion, similar in appearance and composition to the preceding specimen. *British Museum.*

ℑ 14. A small irregularly-shaped concretion, consisting of the fine hairs on the seed of the oat. It is probably from the human subject, and has a plum-stone for its nucleus. *Leverian Museum.*

ℑ 15. Oat-hair concretion, of a rude triangular figure. It has the following history in the Sloanian MS. Catalogue :—" A stone which was drawn out of a woman's anus nigh this place. She had been afflicted with colic pains for some years before the stone was taken from her to that degree that she was perfectly emaciated. She has ever since enjoyed perfect health, and is now about fifty years old.—Dr. Richardson, near Bradford, Yorkshire." *British Museum.*

ℑ 16. A flattened circular concretion and another of a rude triangular figure, described in the Sloanian MS. Catalogue as " Stones brought away from a smith by stool with Elixir Salutis, by Dr. Darcy, after many months or years colic pains." They consist of the ordinary oat concretion, and are coated by a thin, smooth layer of phosphate of lime.
British Museum.

ℑ 17. An oat-hair intestinal concretion from the human subject, of a rude triangular figure. *Mus. Liston.*

CONCRETIONS CONSISTING OF VARIOUS SUBSTANCES.

𝔎 1. Several amorphous, earthy-looking masses of a yellowish red colour, which were taken from the appendix cæci of Colonel Dalrymple. They acquire a slight waxy lustre by friction, and are composed of peroxide of iron, fatty matter, stearate or margarate of lime, with portions of vegetable fibre and a little phosphate of lime.

The following history of the case is taken from the MS. of Mr. Hunter: "I opened Colonel Dalrymple, who died of an inflammation of his bowels, joined with a total stoppage of his stools. He did not go to stool from Tuesday to the Tuesday following, when he died. The physic he took never passed through him, nor did the clysters ever come away. In the meantime he had not starved himself, but had eaten moderately. He had great pain in his belly, and it was vastly tight.

"On opening the abdomen I found that the liver adhered pretty firmly to the muscles there, and also to the diaphragm. I likewise found that it adhered to the stomach by its left concave surface, and on the right to the pylorus, the beginning of the transverse arch of the colon, &c. These adhesions were strong and of old standing; the gall-bladder was about half-full of bile, and its ducts were clear; the epiploon sound but not large, so as to cover the intestines; the small intestines towards the ilium adhered to one another and to parts adjacent, especially in the pelvis; but this adhesion was of a soft, glutinous nature, which showed it to be recent, and a good many red spots on the surface of the peritonæum, especially on that surface that was in contact with the peritonæum of the abdomen. The appendix cæci was vastly large, and on squeezing the colon the air escaped through the coats of the appendix cæci; it adhered to parts it came in contact with, and from it came about three ounces of a putrid matter which lay in the pelvis. On feeling the appendixc æci, I found hard bodies in it, which proved to be hard chalky fæces, some as large as a nut. On examining the inside of the intestines they seemed sound, excepting the appendix cæci, which was vastly inflamed, ulcerated, and in some places mortified. Near the termination of the ilium and the cæcum they seemed thicker in their coats than common, and appeared as if dropsical, and on wounding them I could easily squeeze out a clear water.

"There was a good deal of air in the stomach and the whole of the intestines, also a good deal of fluid, which was mixed with fæces in the colon. The fæces in the colon lay chiefly plaistered to the inside of the coats. The whole canal was clear. The reason for his want of stools must have arisen from a paralysis of the intestines, as no obstruction was

observable, even to the anus; and what strengthens this opinion is, that he did not make water, although there was water in the bladder, and still more strengthened by his losing in a small degree the use of his limbs."

The peroxide of iron was probably derived from the patient having taken carbonate of iron.

K 2. An oblong unlaminated mass, consisting principally of undigested oatmeal. It is evidently an intestinal concretion, and was placed by Mr. Hunter among those from the human subject, but has no history.

Hunterian.

K 3. Three small rounded masses, consisting of fatty matter surrounded by a membranous coat. *Hunterian*

Division II.

CALCULI FROM THE DIGESTIVE TRACT OF THE LOWER ANIMALS.

FROM THE BILIARY ORGANS.

CALCULI CONSISTING PRINCIPALLY OF THE COLOURING MATTER OF THE BILE. (MATIERE JAUNE DE LA BILE, *Thénard*: GALLENBRAUN, *Gmelin*: BILIPHAEIN, *Simon*: CHOLEPYRRHINE, *Berzelius*.)

The brown concretions which are sometimes found in the gall-bladder, and more rarely in the intestines of oxen, are composed almost wholly of the peculiar matter to which the above terms have been applied.

These concretions have been known for a very considerable period, probably long before biliary calculi had been discovered in the human subject. They are of a rich reddish-brown colour, and are sometimes employed by artists, although the colour is not permanent. They are exceedingly light and friable, and readily separate into concentric layers. They vary in size from that of a pea to that of a hen's egg, and are usually of an ovoid figure, but when two or more calculi are contained in the gall-bladder, they often present a very regular cubic or tetrahedric figure. These calculi always possess a musky odour, which appears to be peculiar to the concretions from the Ox. When heated before the blowpipe they do not fuse, but puff up, catch fire and burn for a short time; a bulky carbonaceous ash remains, which almost always contains the carbonates of lime and soda. They partially dissolve in a solution of caustic potass. The liquid is of a deep brownish-red colour, and when neutralized by muriatic acid lets fall a grass-green flocculent precipitate (the Biliverdin of Berzelius and Gallengrün of

Gmelin), which readily dissolves in a solution of ammonia with the same tint. The ammoniacal solution yields a green precipitate on the addition of muriate of baryta. When nitric acid is added to their potass solution, the liquid becomes first bluish, then violet, red, and lastly yellow. Calculi consisting of this substance usually contain mucus of the gall-bladder, bile, with phosphate and carbonate of lime and carbonate of soda.

The facility with which the colouring matter of the bile undergoes chemical changes, and the consequent difficulty of procuring it in a state of purity, have prevented chemists from ascertaining its ultimate composition. It belongs to the class of nitrogenous bodies, and apparently possesses the properties of a weak acid, since it is not only readily soluble in solutions of potass and soda, but forms insoluble compounds with the earthy bases. In many of these concretions it exists partly in combination with lime: the compound does not dissolve when the calculus is digested in a cold solution of potass, but if previously treated with muriatic acid the lime is abstracted, and the residue becomes wholly soluble in the alkaline solution. When separated as completely as possible from the other constituents of the calculus, the colouring matter of the bile is of a fine yellowish-red colour. It is tasteless and inodorous, very slightly soluble in water, alcohol, or in solution of ammonia; when moistened with the latter and exposed to the air it absorbs oxygen and becomes greenish. It dissolves with facility in solutions of potass and soda; the liquid is of a brownish-red colour, but absorbs oxygen from the air and becomes greenish. By solution in an alkaline liquid the colouring matter of the bile undergoes decomposition, and is converted into a substance termed *Gallengrün* by Gmelin, which is thrown down on the addition of an acid in the form of grass-green flocks. This property, together with the peculiar action of nitric acid, are quite characteristic of the colouring matter of the bile, and serve to indicate its presence in calculi, or in any organic fluid.

𝔐. *Colouring Matter of the Bile.*

𝔐 1. The half of a large oval calculus "taken out of an Ox's gall."—*Sloanian MS. Catalogue.* *British Museum.*

𝔐 2. A large oval calculus, another of a cubic figure, and a third of a regular

tetrahedric shape, having its solid angles truncated, which is figured in Plate XVII. From the gall-bladder of the Ox.

𝔐 3. Two large calculi "taken out of the gall-bladder of an Ox."—*Sloanian MS. Catalogue.* One is of a tetrahedric figure, having its edges rounded; the other, which is of a very singular shape, is figured in Plate XVII.
British Museum.

𝔐 4. Fragments of calculi "ex cysti felleâ Bovinâ."—*Sloanian MS. Catalogue.*
British Museum.

𝔐 5. Fragments of a large calculus from the gall-bladder of an Ox.
British Museum.

𝔐 6. A small broken calculus, "ex felle Bovis."—*Sloanian MS. Catalogue.*
British Museum.

𝔐 7. A small irregularly-shaped calculus, described in the Sloanian MS. Catalogue as a "gall-stone found in an Ox's or Cow's gall by Mr. Millington the silk-dyer." *British Museum.*

𝔐 8. Two broken calculi of an oval figure, which were "taken out of the gall-bladder of an Ox."—*Sloanian MS. Catalogue.* *British Museum.*

𝔐 9. Calculi taken from the gall-bladder of a Cow.

FROM THE SALIVARY ORGANS.

The concretions which have been found in the salivary ducts of the Horse, Ass, Elephant and Cow, differ only in composition from those taken from Man, in containing a larger proportion of carbonate of lime. Lassaigne found the earthy components of one of these concretions to consist of carbonate of lime 84, phosphate of lime 3 *; and a specimen analysed by Caventou consisted of carbonate of lime 91·6, phosphate of lime 4·48, with 3·6 of animal matter †. Mr. Morton, in his 'Essay on Calculous Concretions,' quotes a passage from the *Hippopathology* of Mr. Percivall, to the effect that salivary calculi very seldom occur in British veterinary practice; and he has given us the history of

* *Ann. de Chimie,* xix. 174.

† *Journ. de Pharmacie,* xi. 465.

a large calculus which was successfully removed by an Italian professor of veterinary medicine from the left cheek of a mare, and which was contained in a distinct sac communicating by a narrow canal with the duct of Steno.

There are no specimens of salivary calculi from the lower animals in this collection.

FROM THE STOMACH AND INTESTINES.

INTRODUCTION.

The history of intestinal concretions affords a remarkable instance of the tendency of the human mind to attribute miraculous curative powers to substances, the nature and origin of which are enveloped in mystery. These bodies, which modern science has shown to consist merely of the undigested and excrementitious parts of the food of different animals, were formerly termed Bezoars, and were regarded as precious and sovereign remedies for all kinds of disease, were supposed to possess the power of counteracting the effects of poison, and for many ages were held in so much esteem, that they were regarded as valuable and acceptable presents by the native princes of the East.

Although the increasing knowledge and experience of mankind have gradually dispelled such illusions, and stripped these worthless drugs of the reputation in which credulity or cunning had for so long a period enshrined them, the aid of chemistry is required to enable us to form a just estimate of their actual value; and it is remarkable, that the composition of the Oriental Bezoar, which gave value and currency to all the other varieties, has remained to the present time a matter of doubt and uncertainty.

The occasional presence of concretions in the alimentary canal of herbivorous animals must have been known from the earliest period in every part of the globe; it does not, however, appear that any particular value was set upon those taken from the animals inhabiting the colder regions, although they were frequently substituted for the more valued species obtained from animals of warmer climates.

The word Bezoar is of Eastern origin: but authors do not agree as to its exact etymology; some assert that it is derived from two Persian words signi-

fying the destroyer of poison, while others derive it from the Persian name of the wild goat in which the concretions were found *.

Bezoars were divided into two species, the Oriental and the Occidental. The former were brought from Persia, Tartary, and the province of Golconda, where they were found in the stomach of a species of wild goat common in the mountainous districts of those regions. The Occidental Bezoars were taken from a similar animal inhabiting Peru and the West Indies. The Oriental Bezoars were by far the most esteemed; Tavernier informs us that he gave 500 crowns † for a single specimen which he afterwards exchanged to advantage, and that they increased in value according to their size in the same manner as diamonds. For one weighing four ounces he received 2000 livres, or about 150*l.* sterling ‡. The Bezoars were frequently set in hoops of gold or silver, having a chain of the same metal attached by which they were suspended in the liquid to which it was desired they should impart their virtues. Kœmpfer asserts

* "Varias habet hic lapis appellationes: nam Arabibus *Hager* dicitur, Persis *Bezaar*, Indis *Bezar*, Græcis *Alexipharmicum*, Latinis *Contra venenum*, Hispanis *Piedra contra veneno y desmayos*, hoc est, Lapis venena et animi deliquia curans. Conradus Gesnerus in animalium quadrupedum historia de Capra montana agens, scribit, hoc vocabulum *Belzaar* Hebræum esse: nam *Bel* Hebraicâ linguâ dominum significare et *Zaar* venenum, quasi interpretareris dominum veneni: nec immeritò sane tale nomen obtinet, quandoquidem ita venenis resistit, ut illa extinguat et tollat, non secus ac illorum dominus. Hinc sit ut omnia medicamenta venenis resistentia *Bezaardica* per excellentiam nuncupentur." —*Op. Clusii*, fol. edit. 1605, p. 8.

Clusius derives the word from the Persian name of the animal in which the stone is found, an opinion which he appears to have taken from Christopher a Costa, whose writings were translated by Clusius, and are included in the Exoticorum, &c., vide p. 279. A similar derivation is also to be found in Gesner's 'Historia Aromatum': "Vocatur autem hic lapis *Pazar* a *Pazan*, id est hirco, cum Arabibus tum Persis et *Corasone* incolis: nos corrupto nomine *Bezar* atque Indi magis corruptè *Bazar* appellant, quasi dicas lapidem forensem: nam *Bazar* eorum linguâ forum est."—*Clusii Exoticorum* lib. i. p. 216. Dr. John Fryer is very positive on the subject, and says, "The Persians call this stone *Pahazar*, being a compound of *Pa* and *Hazar*, the first of which is *against*, the other is *Poison*, as much as if you should say in Greek *antidoton*, in English *Counter poison*."—*Fryer's Travels*, p. 238, 1698.

Kœmpfer also derives it from the word *Pasahr*, although he denies the compound signification of the word: "Lapis Bezoar Orientalis verus et pretiosus *Pasahr*, ex quo nobis vox Bezoar creata est. Sceptici nostri philosophi nomen petunt ab Hebræa *Bahal* quod dominum, et Persico *Sahr* quod venenum significat, et lapidem veneni domitorem vocant. Sed hæc ex similitudine vocabulorum efficta derivatio est."—*E. Kœmpfer's Amœnitatum Exoticarum &c.*, Fasciculus 2, 4to, 1712.

M. Daubenton in the 'Encyclopédie Méthodique' has adopted *Pazan*, the wild goat of Persia, as the word from which Bezoar is derived.

† About 120*l.*

‡ Tavernier, Six Voyages of, fol. 1677, Translation.

that in Persia he scarcely ever met with any person of consequence who did not possess one of these concretions, which was preserved with great care among his most valued treasures *. If any other proof were wanting of the esteem in which they were and perhaps are still held in Persia, it would be found in the fact, that among the presents sent to the Emperor Napoleon by the Shah of Persia were three Oriental Bezoars.

The composition of the Oriental and Occidental Bezoars has hitherto eluded the research of chemists, although they have been frequently submitted to analysis; neither has it been determined to what particular species of concretion these terms should be applied. From a careful examination of the specimens in this collection, corroborated by the general characters assigned to these calculi by Clusius, Tavernier, Kœmpfer, and other authors, it will be shown in a future part of this work that the true Oriental Bezoar consists of the insoluble organic acid which is deposited from an infusion of gall-nuts when exposed to the air, and to which Braconnot has given the name of *Ellagic acid* †.

The term Occidental Bezoar appears to have been applied by many authors indiscriminately to all concretions not possessing the obvious characters of the Oriental Bezoar. In the Sloanian and Hunterian MSS., several calculi consisting of the earthy phosphates and of vegetable hairs are thus named. Sufficient evidence will however, it is believed, be adduced to prove that the true Occidental Bezoar consists of a vegetable resin, identical in composition with the resinous matter which formed the principal constituent of a calculus examined by M. Goëbel, and to which he has given the name of *Lithofellinic acid*, on the supposition that the calculus examined by him had been taken from the gall-bladder of some foreign animal ‡. It is not however probable that the peculiar constituent of either the Oriental or the Occidental Bezoar was confined exclusively to the animals of one or the other hemisphere, since the resinous and bitter juices from which these concretions are formed exist in the plants of both divisions of the globe. That such was the case with the Occidental Bezoar, we have the direct statement of Kœmpfer, who says that it was found in the wild goats of Persia, and that it was termed *Lapis Bezoar Occidentalis* on account of its similarity to the concretions brought from Peru and the West

* *Amœnitatum Exoticarum* Fasc. 2.

† *Ann. de Chimie et de Physique*, ix. 187.

‡ *Ann. der Chemie und Pharm.* B. xxxix. 1841.

Indies *. In the Hunterian and Sloanian MS. Catalogues these concretions are described as "false West Indian Bezoars"; their beautifully-lamellar structure, and the peculiar characters of the resin of which they are composed, sufficiently attest their real origin.

It is not easy to determine at what period Bezoars were introduced as medicinal remedies, although there is no doubt that they were first employed by the Arabian physicians. No mention of them is to be found in the ancient Greek and Latin authors: Nicolaus Monardes informs us that their use was first recommended by Serapion, Avicenna, Averroes and Avenzoar, names which would carry us back to the beginning of the tenth century †. From the East the use of these bodies as a medicine gradually spread into Europe, where they enjoyed so much reputation that they gave the name of Bezoardics to a large class of pharmaceutical preparations supposed to be peculiarly efficacious in counteracting the effects of poison. These substances were usually of a cordial and tonic nature, although several, as the Bezoarticum Mercuriale, &c., must have been very active remedies. A severe blow was dealt to the reputation of the Bezoar as an antidote to poison by the experiment of Ambrose Paré, who administered it to a criminal condemned to death, and to whom arsenic had been previously given, with what result it is scarcely necessary to add. As a pharmaceutical agent, however, it continued to be employed in combination with other drugs for a considerable time. In Pomet's *Histoire des Drogues*, published in 1735, a whole chapter is devoted to the history and uses of Bezoar; and it is only within the last century that it has been expelled from our own Pharmaceutical Codex, as the mode of preparing the powder of Bezoar is to be found in the London Pharmacopœia for 1746.

The diseases for which Bezoars were accounted sovereign remedies include a very numerous class, and of the most opposite character. Monardes, who appears to have been a great admirer of them, says that they are of great efficacy in vertigo, palpitation of the heart, epilepsy, jaundice, worms, and obstruction of the bowels, melancholy, and the whole class of epidemic and contagious fevers. He has given us the history of three cases in which their remedial virtues were exhibited against the effects of poison. It is to be observed,

* *Op. cit.* p. 397.

† *Exoticorum* lib. x. a Carolo Clusio.

however, that in all these cases there is no good evidence of poison having been taken. Even the acute and sagacious Kœmpfer attributes some virtue to the Oriental Bezoar, as he was in the habit of prescribing a few drops of the solution of the stone in nitro-muriatic acid; and he argues that no conclusion can be drawn from the experiment of Ambrose Paré, since he thinks it probable that the proper Bezoar was not administered to the unhappy subject of experiment, as he asserts that all Bezoars do not possess the same efficacy, some being only of power against mineral poisons, and others against those from the animal and vegetable kingdom.

Kœmpfer informs us that it was a very general custom in Persia to take a dose of the powder at the beginning of the year, in the belief that the body would be then protected during the ensuing year from the effects of poison or disease, especially if the medicine had been taken under the influence of a benignant star.

It must be, however, remarked, that in some few instances Bezoars did probably possess a small share of the remedial virtues so liberally bestowed upon them. In several of the concretions in this collection, bile in a more or less altered state has been detected. The tincture of one of these calculi is said in the Sloanian MS. Catalogue to be, "when taken in wine, not only good against all poisons, but that it strengthens a weak stomach and cures gripes in the bowels," properties which we may refer either to the bile it contained, or the wine in which it was infused. There is also reason for believing that the Bezoars were sometimes steeped in infusions of active medicinal plants.

The snake-stone, or *Pedra de Cobra* as it was termed by the Portuguese, on account of its efficacy against the bite of venomous snakes, also affords a good illustration of these bodies actually possessing remedial powers, although the *modus operandi* was very different from that which was asserted. The so-called concretions in the Museum are composed of calcined bone-earth finely powdered, and mixed with musk and some aromatic gums into the form of small, flattened, oval masses. They are highly porous and absorbent; consequently, if a number of these stones were applied in quick succession to a recent bite, they might abstract the poison along with the blood by capillary attraction. Kœmpfer says that it was necessary to have two stones, so that when one fell off the other could be applied; and Tavernier directs that, "if the person be

not much wounded the place must be incised, and the stone being then applied will not fall off till it has drawn all the poison to it." He also informs us, " that there are two ways to try whether the serpent-stone be true or false. The first is by putting it into the mouth, for then it will give a leap and fix to the palate; the other is by putting it in a glassful of water, for if the stone be true the water will fall a boiling, and rise in little bubbles quite up to the top of the glass;" facts which clearly prove that the value of the stone depended upon its porosity. The specimens in the Museum are evidently artificial compounds, and both Kœmpfer and Tavernier agree that these stones were manufactured by the Brahmins, and were not taken from behind the hood of the Cobra di Capello, as was commonly believed.

For the fullest and most accurate description of the various species of Bezoars we are indebted to Kœmpfer, who took considerable pains in investigating their history, and who, in order to convince himself of the real origin of the Oriental Bezoar, went a journey of three days into the regions inhabited by the goats. He enumerates the following species: ***Masang de Vaca***, ***Pedra de Porco*** and ***Pedra de Porco spuria***, ***Bolus pilosus Porcinus***, ***Pedra de Cobra***, ***Pedra Cordial*** sive ***Lapis de Goa***, ***Coagulum resinosum bezoarticum***, ***Lapis Bezoar Orientalis***, ***Pedra Bugia***. These concretions were commonly sold as drugs in India and Persia, and Kœmpfer says were frequently offered to him as the genuine medicinal stone. With the exception of the ***Masang de Vaca***, which was taken from the gall-bladder of oxen, and was doubtless composed of the brown colouring matter of the bile, and the ***Pedra de Cobra*** and ***Lapis de Goa***, which were artificial compounds, all the others are intestinal concretions; and as many of the concretions in the Hunterian and Sloanian Collections were thus designated, we shall be enabled, with the accurate description given by Kœmpfer of their external characters, to point out their chemical composition.

The high price set upon Bezoars induced numerous imitations, for the most part composed of chalk and pipe-clay, mixed with musk and various odoriferous gums: in order to give them the high polish of the genuine Oriental Bezoar, they were frequently gilded on the surface. Kœmpfer accuses the eunuchs of the seraglios of manufacturing and vending the false Bezoars. Several of these factitious compounds exist in the Sloanian and Hunterian Collections. A specimen, presented by Mr. Long to the College, had been pur-

chased for fifteen guineas by a gouty gentleman as an antidote to calculous disorders, and was used by him to counteract the injurious effects of punch; for which purpose some of the stone was scraped into the liquor. As the stone consists almost entirely of chalk, it is probable that its efficacy was not altogether imaginary. The *Pedra Cordial* or *Lapis de Goa* appears to have been a species of quack medicine; according to Kœmpfer, it was a compound of various aromatic drugs, mixed with the powder of Bezoar and rolled into globular or oval masses, their external surface being often gilded. This substance was much used as a tonic medicine by the Europeans resident in the East, and was prepared by the Romish priests at Goa, especially by one Nicolaus Monitius, whose manufacture was identified by the figure of a goat being stamped upon one side and the letters N. M. on the other.

Some other varieties of calculi have been described by different authors, as the *Lapis Caymanum* seu *Crocodili*, probably a urinary calculus; the *Lapis Tiburonum* from the seal; but as there are no such specimens in this collection, and their composition has not been determined, any further notice of them would be useless.

The modern history of intestinal concretions may be said to begin with the experiments of Fourcroy and Vauquelin in 1803, who first accurately investigated the composition of these bodies. They divided them into the seven following species: 1. Calculi consisting of superphosphate of lime; 2. of phosphate of magnesia; 3. of phosphate of magnesia and ammonia; 4. of a biliary matter analogous to the colouring matter of the bile; 5. resinous concretions; 6. fungous concretions; and lastly, the hair-balls, or ægagropiles as they were formerly termed*.

The Oriental Bezoars were supposed to belong to the resinous class of concretions, of which Fourcroy recognised two varieties; the first variety were of a light green colour, and had a slightly bitter taste; they readily dissolved in hot alcohol, and the greater part was deposited upon cooling in a crystalline form. These concretions were regarded by Fourcroy as consisting of a substance resembling bile, and of a dry colourless resin. They have been already alluded to as constituting the true *Occidental Bezoar*, and as being identical with the

* *Annales du Muséum National*, iv. 330, 1804.

lithofellinic acid calculi of Prof. Goëbel. As there cannot, however, remain much doubt as to the vegetable origin of these calculi, the name of *resino-bezoardic* acid has been given to them,—a name which does not materially differ from that of *résine animale bezoardique* originally imposed by Fourcroy and Vauquelin.

The second variety of resinous concretions had a brown or violet colour; they did not possess a bitter taste, were insoluble in alcohol either hot or cold, but readily dissolved in solution of potass or soda. When submitted to destructive distillation, they yielded a concrete yellow sublimate having the taste and smell of soot, and insoluble in water or alcohol. From the examination of the specimens in this collection, it has been determined that these concretions are composed of ellagic acid, and that the term of Oriental Bezoar should be exclusively applied to them.

The composition of the Oriental Bezoar was afterwards investigated by Berthollet, who has given us a most masterly analysis of the three calculi which had been sent to Napoleon by the Shah of Persia. Berthollet considered them to be composed of the woody fibre or lignin of the vegetable substances on which the animals fed*. Dr. Thomson, in his recent work on Animal Chemistry, has regarded them as a separate species under the name of *ligniform*; there is, however, no doubt that they are identical in composition with the second variety of the resinous concretions of Fourcroy. The nature of the Oriental Bezoar was also examined by John†, and very recently by M. Lippowitz, both of whom have regarded it as consisting of a peculiar matter, to which the last-mentioned chemist has given the name of *bezoaric acid*‡.

Several concretions from the lower animals have been discovered in the Hunterian collection similar in composition to the oaten concretions from Man, being composed of the vegetable hairs of different species of plants, mixed with spiral vessels, portions of cellular tissue, woody, and other foreign matters. In some of these concretions the quantity of earthy phosphates exceeds that of the vegetable matter, and a species of mixed calculus results which has been long known to farriers under the name of *Dung-balls*. These calculi are probably identical with the fungous concretions of Fourcroy, which in most chemical

* *Mémoires de la Société d'Arcueil*, tom. ii. p. 484.

† *Chem. Schr.* iii. 38. Gmelin's *Handbuch der Chemie*, B. ii. S. 828.

‡ Simon's *Beiträge zur Phys. und Pathol. Chemie*, B. i. S. 463.

works are described as consisting of pieces of the *Boletus igniarius* which had been swallowed by the animal and become cemented together by mucus. They commonly contain a resinous matter, which sometimes appears to be of vegetable origin, but more frequently it consists of some of the numerous class of resinous bodies resulting from the decomposition of the bile. One of these concretions, which had been apparently moulded in the cæcum of some animal, contained a very large quantity of a colourless crystalline resin, resembling in most of its properties the *cholic acid* of Gmelin, but so far differing that it could not be precisely referred to that or any other of the known crystalline resins of the bile. The famous *pedra de porco* also belongs to this class of concretions, and it is not improbable but that its virtue depended upon the bile and its products, which the specimens in this collection have been found to contain*. *Lithofellinic acid* has not hitherto been detected in any of these concretions.

With the exception of the above concretions, intestinal calculi are remarkably pure. Those which have a compact laminated or a crystalline structure usually contain but a very small proportion of other salts; phosphate of lime is generally to be found in the triple phosphate calculus, but never to such an amount as to render the calculus easily fusible; carbonate of magnesia is also generally present in concretions consisting of carbonate of lime. Sulphate of lime, peroxide of iron, and the various saline constituents of the gastric and intestinal juices, together with portions of vegetable tissue, form likewise accidental components of these concretions.

Intestinal concretions always contain a large quantity of animal matter, which is uniformly diffused through the calculus and separates in thin layers when the earthy constituents are removed by a diluted acid. The bulk of the animal matter is certainly of an albuminous character, although when digested in boiling water it frequently yields a small quantity of extractive matter, which in some respects resembles gelatine. When examined by the microscope it presents the

* The examination of these calculi has perhaps proved the least satisfactory of any class of concretions. The few points of difference between resinous bodies in general, the numerous substances into which the bile is converted by decomposition, and the imperfect manner in which its resinous products have been investigated, together with the number of ingredients which the calculi contained, and the small quantities on which it was possible to operate, presented obstacles which it was found almost impossible to surmount.

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Among the calculi brought from the British Museum was a large pear-shaped concretion, weighing more than ten pounds, which was stated to have been taken from the stomach of a gelding above seventeen years old. On submitting this calculus to analysis, it was found to resemble in composition the urinary concretions from the Horse, being composed of carbonate of lime mixed with carbonate of magnesia and a small quantity of oxalate and phosphate of lime. As it did not have any foreign body for its nucleus, and no remains of vegetable matter could be detected between its layers, it is most probable that it was taken

* The examination of these calculi has perhaps proved the least satisfactory of any class of concretions. The few points of difference between resinous bodies in general, the numerous substances into which the bile is converted by decomposition, and the imperfect manner in which its resinous products have been investigated, together with the number of ingredients which the calculi contained, and the small quantities on which it was possible to operate, presented obstacles which rendered their exact analysis almost impossible.

from the urinary bladder, among which concretions it has, therefore, been placed. Carbonate of lime is, however, frequently present in intestinal concretions of oxalate of lime, as 11 per cent of that salt was found in a specimen in this collection, and M. Guibourt has given the analysis of a concretion, the earthy salts of which consisted of carbonate of lime 43·55, oxalate of lime 34·30, sulphate of lime 2·85, carbonate of magnesia 2·34*.

Intestinal concretions always contain a large quantity of animal matter, which is uniformly diffused through the calculus and separates in thin layers when the earthy constituents are removed by a diluted acid. The bulk of the animal matter is certainly of an albuminous character, although when digested in boiling water it frequently yields a small quantity of extractive matter, which in some respects resembles gelatine. When examined by the microscope it presents the appearance of a thin, transparent, structureless or slightly granular membrane, in which only a few epithelial particles are occasionally seen.

The minute branched tubes already described as occurring in urinary calculi are very abundant in these concretions, and many of them distinctly belong to the class of Confervæ: others more closely resemble the irregular tubes found in the animal matter of coral and shell†. It therefore appears from its structure and chemical characters that the animal matter of intestinal concretions does not consist merely of mucus, as hitherto supposed, but that it forms a distinct tissue similar to that of urinary concretions.

Intestinal concretions occur more frequently in herbivorous than in omnivorous animals. In carnivorous animals they have never been observed. Leopold Gmelin states that the phosphate of magnesia calculus is found only in the intestines of carnivorous animals‡; but there is most probably some error in this statement, as all the concretions in this Museum belonging to that variety have some vegetable substance, as a seed, &c., for their nucleus. The reason of the occurrence of calculi in animals feeding upon vegetable matters is sufficiently obvious, if we take into consideration the nature of their food, the complicated structure of their digestive apparatus, and the composition of the concre-

* *Journal de Pharmacie et de Chimie*, tom. 3. p. 124.

† Vide a paper by J. S. Bowerbank, Esq., F.R.S., in the Transactions of the Royal Society for 1842.

‡ *Handbuch der Chemie*, B. 2. S. 1448.

tions themselves. The whole series of intestinal calculi are composed of the various earthy salts, or other insoluble constituents of vegetable substances. The quantity of inorganic constituents is smaller in animal than in vegetable food, and the whole is required to enter into the composition of the new tissues, consequently these concretions are never found in carnivorous animals. The complicated stomachs of the Ruminants, and the large size and length of the alimentary canal in herbivorous animals generally, must not only favour the formation of a calculus, but also render its expulsion, when formed, less easy. Another disadvantage also arises from the circumstance, that during the evacuation of their excrement these animals usually stand upon all-fours; the gut is therefore placed in a horizontal position, and is consequently unaided in its efforts by the power of gravity.

Intestinal calculi are found of every size from that of a small nut to several inches or even a foot in diameter. Of the earthy concretions, those consisting of phosphate of magnesia and ammonia attain the largest size. There is one of these calculi in the Museum which measures ten inches in diameter and weighs nearly eighteen pounds. A hair-ball taken from the stomach of a cow is also in this collection which has attained the enormous size of forty inches in circumference.

Oxalate of lime concretions, and those composed of vegetable hairs are also frequently of large size. Ellagic acid and resino-bezoardic (*lithofellinic acid*) concretions are usually the smallest; there is, however, one of the latter in the Museum nearly four inches in diameter, and which has evidently been accompanied by other concretions. The figure of intestinal calculi usually depends upon the form of the nucleus; as they increase in size they always approximate to an oval or spherical shape. Their external surface is either smooth, tuberculated, crystalline, or irregularly nodulated. Phosphate of lime, ellagic acid and resino-bezoardic calculi are invariably smooth and polished, while triple phosphate calculi are either smooth or crystalline. The only concretion which possesses a perfectly characteristic exterior is that composed of phosphate of magnesia, which is covered with irregularly-shaped, flattened plates or tubercles, somewhat resembling the folds of the skin of the rhinoceros, from which circumstance they were formerly termed Rhinoceros Bezoars.

In the Horse the stomach appears to be the most frequent seat of concretions,

from whence they descend into the intestinal canal, in the narrower parts of which they sometimes become impacted, where they produce violent inflammation, and occasionally rupture, of the intestine*.

With regard to the manner in which these concretions are formed, it is exceedingly difficult to give a satisfactory explanation. That they are composed of some one or other of the insoluble parts of the food of the animal is easily demonstrated; but it is not so easy to explain why these substances should occasionally become united into a compact laminated or crystalline mass. The presence of a foreign body in the stomach, as a piece of wood or a stone, is certainly one of the conditions necessary for the formation of a calculus, and by some authors this fact has been supposed to favour the notion of the calculous matter being secreted by the mucous membrane as a means of protecting itself from injury. The difference in the composition of these concretions, however, clearly shows the incorrectness of that view of their formation; according to which they should uniformly consist of phosphate and carbonate of lime.

M. Guibourt, who agrees with Kœmpfer as to the vegetable origin of the Oriental Bezoars, has thrown out the idea that the resinous and other constituents of the plants have been absorbed into the system of the animal and afterwards deposited in the various organs of the body, and he adduces some very remarkable facts, with regard to the composition and peculiarities of the odour of various kinds of castoreum, in support of this hypothesis †. The circumstance of the Oriental Bezoars being usually found in some part of the stomach of the wild goat, militates however very strongly against the notion of their being the products of secretion.

The opinion which at the present time will probably meet with the most ready assent is, that the earthy bases, or the insoluble vegetable constituents of the calculus, are separated from the food during the act of digestion, and that, assisted by a morbid condition of the gastric or intestinal juices, they have become simply aggregated together as in the ellagic acid and resinous concretions, or deposited in the crystalline form from a previous state of solution, as in the

* Morton on Calculous Concretions in the Horse, &c.

† *Journal de Pharmacie et de Chimie*, Fevrier 1843.

triple phosphate and phosphate of lime concretions; the foreign body forming the nucleus merely favouring the process of crystallization by affording a point on which the solid matter is first deposited.

The intestinal concretions from the lower animals have been divided into the following classes. The figures indicate the number of specimens belonging to each variety at present in the Museum. Ambergris has been placed among them, as it is now well ascertained that it is formed in the intestines of the Cachalot or Spermaceti Whale, *Physeter macrocephalus*. The remarkable analogy in the chemical relations of its fatty matter to cholesterine would however lead us to regard it as a product of the biliary organs; in fact, that it is the cholesterine of the Whale.

O. Calculi consisting principally of animal hairs.—*Ægagropiles.*		56
P.	vegetable hairs.	32
Q.	ellagic acid.—*Oriental Bezoar.*	19
R.	resino-bezoardic acid. *Occidental Bezoar.*	23
S.	phosphate of magnesia and ammonia	65
T.	diphosphate of magnesia. . . .	15
U.	diphosphate of lime.	58
W.	oxalate of lime.	5
X.	ambergris.	4

CONCRETIONS CONSISTING OF ANIMAL HAIRS.

The hairs which are swallowed by animals while licking themselves frequently become felted together in the alimentary canal, and form the solid masses commonly known by the name of Hair-balls. These concretions are of common occurrence in Goats, whence the term of Ægagropiles became applied to them*. They were also termed Bezoar Germanicum, from their being brought from Germany, where they were pretended to be formed from the *Doronicum* or *Wolf'sbane* on which the goats fed. Hair-balls are usually of a globular or

* Αἴγαγρος, a wild goat, and πῖλος, felt.

regular oval figure; they frequently attain a very large size; one of the specimens in this collection, taken from the stomach of a Cow, measures ten inches across. In some of these concretions the hair appears on the exterior, and owing to the rotatory motion which the calculus undergoes in the stomach and intestinal tube, the hairs become disposed in a very regular manner around its long axis, as is shown in Plate XVI. fig. 5; others are coated by a thin crust, composed of the phosphates or carbonates of lime and magnesia. It is said that these are found only in the intestines.

Mr. Morton informs us that hair-balls are commonly found in the first division of the stomach of calves*, and according to Mr. Youatt, they occur in the rumen and abomasum of cattle. In the abomasum they are composed exclusively of hair irregularly matted together, while those of the rumen generally contain a mixture of food or earthy matter, with a fragment of stone or a nail in the centre.

Several of the concretions in the Museum are exceedingly impure, being mixed with vegetable hairs, bran, and the earthy constituents of the food of the animal. Very few have any foreign body as their nucleus.

E. *Animal Hairs.—Ægagropiles.*

E 1. An oblong hair-ball, the hairs of which are arranged in a regular spiral manner around its long axis. Vide Plate XVI. *Hunterian.*

E 2. A similar specimen, having a spherical figure, the hair coarse and of a grey colour; apparently from the Goat. *Hunterian.*

E 3. A circular hair-ball, apparently from a Cow. *Hunterian.*

E 4. A large flattened circular concretion, also from a Cow. *Hunterian.*

E 5. Hair-ball from a Cow, of a globular figure. *Hunterian.*

E 6. A nearly circular hair-ball, the hairs of which are not arranged in a uniform manner around one of its axes, but pursue opposite directions. This circumstance arises from an alteration in the rotatory motion of the concretion while in the intestine. *Hunterian.*

* On Calculous Concretions in the Horse, &c.

7. A similar specimen. *Hunterian.*

8. A large round concretion from the Cow, the hairs of which preserve an uniform direction. *Hunterian.*

9. An egg-shaped hair-ball, the surface of which has been attacked by moths. *Hunterian.*

10. A globular hair-ball, divided in the direction of its external hairs. *Hunterian.*

11. A large, flattened, oval hair-ball, divided longitudinally. *Hunterian.*

12. An oval mass, composed of hogs' bristles, mixed with a large quantity of vegetable fibre and earthy matter. *Hunterian.*

13. Twenty-one flattened, oval concretions, taken "from a Calf." They are composed of hair and undigested vegetable matter. *Hunterian.*

14. A section of a globular hair-ball, coated by a thin crust composed of phosphate of lime with phosphate of magnesia and ammonia, carbonate of lime and intestinal mucus. "From the stomach of a Goat, Mosco." *Hunterian.*

15. A spherical hair-ball, the surface of which is coated by a thin crust of a light grey colour, consisting principally of carbonate and phosphate of lime. *Hunterian.*

16. An egg-shaped concretion of hair, coated with a crust composed principally of phosphate of magnesia and ammonia; probably from the Cow. Vide Plate XVI. *Leverian Museum*, 1806.

17. A flattened circular hair-ball, also coated by an earthy crust of a dark brown colour. *Hunterian.*

18. A similar specimen, undivided. *Hunterian.*

19. A similar specimen, of a light brown colour. *Hunterian.*

20. A flattened circular hair-ball, having an earthy crust on its exterior. *Hunterian.*

21. A globular hair-ball, described in the Sloanian MS. Catalogue as

"Boopila corticata in ventriculo veteris vaccæ in pago Gais, cantonis Abatiscellani reperta. From Dr. Lavater, from Switzerland."

British Museum.

22. A spherical concretion, consisting of closely-felted, dark-coloured hair, having a dark brown tuberculated crust, consisting principally of phosphate, sulphate and carbonate of lime; "said to have been found on the Mediterranean, near the shore." *Hunterian.*

23. A large, flattened, circular hair-ball, coated by a thin earthy crust, taken from a Cow. Presented to Mr. Hunter by Sir Hector Munro. *Hunterian.*

24. A similar specimen of a regular oval figure. *Hunterian.*

25.
26.
27.
28. Hair-balls, coated by a thin crust of earthy matter. These concretions are nearly alike in colour, size and general appearance. *Hunterian.*

29. A similar concretion, divided, brought from the Cape of Good Hope. *Hunterian.*

30. A similar concretion, undivided, taken from the stomach of a Highland Goat. *Hunterian.*

31. A divided hair-ball, having a thick earthy crust. *Hunterian.*

32.
33.
34. Small globular hair-balls, covered externally by earthy matter. *Hunterian.*

35. A flattened oval concretion, having a thin earthy crust. *Hunterian.*

36. A section of a similar concretion. *Hunterian.*

37. A small globular concretion, the earthy crust of which is irregular, and of a light grey colour. *Hunterian.*

38.
39.
40.
41. Globular concretions, consisting of short hair, with vegetable and earthy matter. These concretions do not possess an earthy crust, but the materials of which they are composed are so blended together, that the hair does not appear at the surface.

42. A small oblong ball, composed of hair and vegetable matter rolled and felted together. "From the stomach of a Porcupine." *Hunterian.*

43. A small round ball, composed of various coloured hairs, many of them from two to four inches in length. "From the stomach of a young Cuckoo." *Hunterian.*

44. An oblong concretion, composed of Cow's hair. *Hunterian.*

45. "An Ox hair-ball from the Orkneyes, from Dr. Reston." The hair is long, of a dark brown colour, and is arranged in various directions on its surface.—*Sloanian MS. Catalogue.* *British Museum.*

46. A small hair-ball, made up of long black and white hairs. Taken from the stomach of a Chilian Ox. *Presented by W. Cuming, Esq*, 1842.

47. A hair-ball of a light brown colour, having a rude triangular figure. From a Cow. *Leverian Museum.*

48. An oblong mass of grey-coloured hair, felted together in the alimentary canal of some animal, probably the Goat. *Leverian Museum.*

49. A large globular ball from a Cow, the hairs being disposed in a very regular manner around its long axis. From the stomach of a Cow. *Presented by William Clift, Esq.*, 1820.

50. A large, flattened, circular hair-ball, uniformly coated by a smooth crust, consisting of phosphate and carbonate of lime: "A very large Tophus Bovinus, taken out of the first ventricle of a large fat Ox slaughtered at Chelsea. Given to me by the butcher that took it."—*Sloanian MS. Catalogue.* *British Museum.*

51. A perfectly globular hair-ball, covered by a smooth earthy crust. *Presented by Wm. Clift, Esq.*, 1807.

52. A similar specimen, of a flattened oval form; the earthy crust consists of phosphate and carbonate of lime, with phosphate of magnesia and ammonia. From a Cow. *Presented by J. Moore, Esq.*, 1815.

53. A small globular hair-ball, coated with a smooth earthy crust, said to have been taken from some part of the alimentary canal of a Cow. *Presented by Wm. Clift, Esq.*, 1822.

⊕ 54. A large hair-ball, surrounded by an earthy crust. Taken out of the stomach of an Ox slaughtered at Buenos Ayres.
Presented by W. A. Hillman, Esq., 1843.

⊕ 55. Four small globular concretions, being part of twenty that were taken from the stomach of a Lamb: they are made up of wool closely felted together. *Presented by Everard Home, Esq.*, 1807.

⊕ 56. A very large hair-ball, taken from the intestines of an Ox that was slaughtered at Buenos Ayres. It is nearly spherical, is coated by a thin earthy crust, and measures forty inches in circumference. *British Museum.*

CONCRETIONS CONSISTING OF VEGETABLE HAIRS.

The small hairs which cover the surface of most plants occasionally become felted together in the alimentary canal of herbivorous animals, and form concretions similar in most respects to those already described as occurring in the human subject. These concretions do not possess any regular appearance or structure; some are nothing more than a mass of vegetable fibre, earthy matter, &c., confusedly aggregated together, while others possess a laminated structure, and have a soft velvety feel. In addition to the vegetable hairs, of which the bulk of the concretion usually consists, portions of cellular tissue, woody fibre, and spiral vessels are to be found mixed with gum, resin, and an extractive matter resembling ulmic acid, together with various saline and earthy salts, sand, and the hairs of the animal. They also contain variable quantities of more or less altered bile, which appears to have been absorbed by the concretion and become decomposed. A concretion in this Collection, taken apparently from the cæcum, was found to contain above fifty per cent. of a crystalline nitrogenous resin, resembling in most of its properties the cholic acid of Gmelin, mixed with various other products resulting from the more or less complete decomposition of the bile, and which constitute the biliary resin of Gmelin* The concretions termed *Pedra de Porco* in the Sloanian MS. Catalogue were found to have a

* The substance termed biliary resin by Gmelin consists of cholinic, fellinic and choloidic acids, with dyslysine, &c., the relative proportion and even the nature of which differ according to the more or less complete decomposition of the bile.

similar composition. Kœmpfer describes two varieties of this concretion, a true and a false. The first, he says, was taken from the gall-bladder of the Porcupine, that it was extremely valued by the Malays for its medicinal virtues, who set it in hoops of gold and silver: the false stone, on the other hand, was taken from the stomach of the Porcupine, and although it resembled the former in some respects, it was of a less regular shape and was mixed with hairs. He refers the bitter taste of these concretions to the bile they absorbed, and says that the presence of a stone in the stomach was indicated by the frequent attempts of the animal to vomit*. The figures given by Kœmpfer of these concretions correspond with some of the specimens in the Museum; but the only difference between the true and false stone appears to be, that one contains a larger quantity of vegetable fibre, and there is every reason for believing that both kinds were taken from the stomach or some other part of the alimentary canal of the Porcupine.

In the Horse these concretions usually occur in the cæcum and colon. They frequently contain large quantities of phosphate of magnesia and ammonia, with undigested food, &c., and are termed by farriers *Dung-balls.* Horses not uncommonly suffer from the presence of these concretions, and they sometimes produce rupture of the intestine.

𝔓. *Vegetable Hairs.*

𝔓 1. A section of a large round concretion, composed of the setæ on the oat-seed, mixed with earthy matter. It measures five inches and a half in diameter, and was probably taken from a Horse. *British Museum.*

𝔓 2. A section of a similar concretion from the Horse. It is of an oval figure, its exterior is tuberculated, and it has a horseshoe nail for its nucleus.
Presented by Sir Wm. Blizard, 1810.

𝔓 3. A large spherical concretion, similar in composition and structure to the preceding specimen. Its exterior is tuberculated and of a very dark colour. *Hunterian.*

𝔓 4. A similar concretion. *Hunterian.*

* *Op. cit.*

℔ 5. A globular mass of vegetable hairs and fibre, mixed with earth... The exterior is tuberculated and of a dark colour. *Brit...*

℔ 6. A globular concretion, which measures four inches and a h... and was taken from the rectum of a Horse. The anima... a considerable distance at a quick pace on the day of ... return to the stable it laid down and rolled abou... agony, and shortly after died. The calculus consists ... mixture of the setæ of the oat-seed and earthy matt... is extremely rugged, is coated by a crust of phospha... ammonia. *Presented by Sir H...*

℔ 7. Twenty-one laminated concretions, consisting a... hairs. In the Sloanian MS. Catalogue they a... given to Sir Hans Sloane by a butcher, wh... stomach.

℔ 8. Seven concretions, similar in compositio... ceding.

℔ 9. Four small concretions, composed of ve...

℔ 10. An intestinal concretion, having a re... posed of fine vegetable hairs, and ... *Prese...*

℔ 11. A globular concretion, similar in ... in the Sloanian MS. Catalogue ...

℔ 12. A small flattened concretion, ... a cherry-stone; described ... Occidental Bezoar." It ... human subject.

℔ 13. A small concretion, ...

℔ 14. A large concretion, of ... been moulded in the ...

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of long vegetable hairs, mixed with hay, sand, &c.; the rest of the calculus is composed of substances derived from the decomposition of the bile which the calculus has absorbed while in the intestine. The principal ingredient is a colourless resinous matter, which crystallizes in small transparent prisms, usually arranged in stellate tufts. It readily fuses into an amorphous vitreous mass; when heated more highly it swells up, catches fire, and emits the odour of burning animal matter. It is sparingly soluble in water, dissolves readily in alcohol, and the solution is precipitated by water; the precipitate after some time becomes crystalline. It dissolves with great facility in solutions of potass, soda and ammonia, the solutions when evaporated form transparent vitreous masses without any crystalline structure. From its alkaline solutions this substance is thrown down by muriatic, sulphuric and acetic acids as a gelatinous precipitate, which after a short time becomes aggregated into small crystalline tufts. Its ammoniacal solution is not decomposed by boiling, and gives a white flocculent precipitate with dilute solutions of the nitrates of baryta, lead, silver, and muriate of lime. When heated with a mixture of lime and soda, ammonia is evolved. This substance, therefore, resembles very closely the cholic acid of Gmelin, the chief difference being that its soda salt is not crystalline. Mixed with the above substance was a considerable quantity of the biliary resin of Gmelin, with bile, gum, and a vegetable extractive matter. *Hunterian.*

𝔓 15. The outer layers of an intestinal concretion, described in the Sloanian MS. Catalogue as "a Porcupine stone; the tincture drunk with wine is good for all sorts of poisons. It is of great value in Holland; it strengthens a weak stomach and cures gripes in the bowels. From Dr. Cyprianus. 'Tis cutt or used, and lyes SSS." (*stratum super stratum*). This concretion consists of 35 per cent. of long divaricating hairs, mixed with spiral vessels, portions of woody fibre, cellular tissue, and sand. It also contains bile, biliary resin, mucus, together with a vegetable extractive matter resembling ulmic acid and gum. This concretion resembles those described by Kœmpfer under the name of *Pedra de Porco spuria*, which he says were found in the stomach of the Porcupine.

It is however probable that the above was taken from a larger animal, perhaps from the Deer or Goat. Vide Plate XVII. figs. 9, 10.
British Museum.

𝔓 16. An intestinal concretion, of a rude tetrahedric figure with flattened sides from having been in contact with other concretions. It consists of long spindle-shaped vegetable hairs, mixed with spiral vessels, &c.; it possesses a bitter taste, and resembles in its general composition the preceding specimen. *Hunterian.*

𝔓 17. A cylindrical mass of coarse vegetable hairs. It is flattened at each end, and has apparently been in contact with other concretions.
British Museum.

𝔓 18. An oval calculus, of a brown colour, having an earthy texture. This concretion is described in the Sloanian MS. Catalogue as "ex cysti fellea bovina." It is however an intestinal concretion, and consists of a large quantity of biliary resin mixed with various-shaped vegetable hairs, fragments of cellular tissue and other parts of plants; it also contains vegetable extractive matter, gum, and a small quantity of bile. *Hunterian.*

𝔓 19. Two globular concretions, surrounded by silver hoops and attached to each other by a chain of the same metal. They possess a compact laminated structure, and are composed of short vegetable hairs, mixed with woody fibre and spiral vessels, the whole being cemented together by a bitter extractive matter, gum, resin, mucus and bile. In the Sloanian MS. Catalogue they are said to be "two stones of *Porco*, procured at the Jesuits' college at Lisbon by Dr. Sarmento of Zeylon." These concretions are very similar in appearance to those figured by Kœmpfer in the *Amœnitates Exoticæ* as the *Pedra de Porco pretiosa Malaccensis*, which he says were procured from the gall-bladder of the Porcupine. When a portion of one of these concretions is heated it emits a disgusting odour, resembling that of the Porcupine. Vide Plate XVII. fig. 11.
British Museum.

𝔓 20. A section of a small concretion, apparently similar in composition to the preceding. It has a piece of twig for its nucleus. *British Museum.*

𝔓 21. An oval calculus, similar in composition to the preceding specimen. Its exterior is coated by a dark brown resinous-looking matter, which has a very bitter taste. "*Piedra del Porco spinosa,* from the island of Bona. From Mr. Van Huffe."—*Sloanian MS. Catalogue.* *British Museum.*

𝔓 22. A section of a small dark brown concretion, consisting principally of vegetable hairs. *Hunterian.*

𝔓 23. An oblong mass, consisting of hay and other vegetable matter mixed with hog's bristles. "Massa oblonga setacea in ventriculo Suillo reperta. From Dr. Lavater. From Switzerland."—*Sloanian MS. Catalogue.* *British Museum.*

𝔓 24. Three oblong masses and a section of a fourth, all of them consisting of undigested vegetable fibre. Described by Mr. Hunter as "Balls of the Chamois." *Hunterian.*

𝔓 25. A coiled mass of vegetable hairs, coated by a thin crust of the earthy phosphates. "Found in the stomach of an Ox."—*Sloanian MS. Catalogue.* *British Museum.*

𝔓 26. A small oval concretion, composed of undigested vegetable fibre, coated by a thin dark-coloured earthy crust. Taken from the stomach of a Buffalo. *Presented by Dr. Richardson,* 1822.

𝔓 27. An oblong flattened mass, similar in composition to the preceding. *Hunterian.*

𝔓 28. A loosely compacted mass of vegetable fibre, from the intestine of some animal. *Hunterian.*

𝔓 29. A small spherical ball, precisely similar in composition to the preceding. *Hunterian.*

𝔓 30. An oblong mass of undigested vegetable fibre, described in the Sloanian MS. Catalogue as "an Ægagropila or ball taken out of the stomach of the Rupicapra or Chamois, with a black crust upon it. Given me by Dr. Lavater, from Swisserland. Ægagropila completa, oblonga, cortice obducta." *British Museum.*

𝔓 31. A round ball, composed of coarse vegetable fibre, mixed with earthy matter. *Hunterian.*

𝔓 32. An oblong mass of hair and undigested vegetable matter, from the stomach of a Kangaroo. *Presented by R. Owen, Esq.*, 1835.

CALCULI CONSISTING OF ELLAGIC ACID.—THE ORIENTAL BEZOAR.

When an infusion of gall-nuts is exposed to the air for some weeks, and the vegetable mould which forms on its surface is removed from time to time, a crystalline powder is gradually deposited, which consists for the most part of impure gallic acid; if this deposit be digested in boiling water its gallic acid is dissolved, and there remains behind a dirty buff-coloured powder. This insoluble residue contains gallate of lime, ulmic acid and some other matters, but consists chiefly of the substance to which Braconnot has given the fanciful name of Ellagic acid, derived from the word *galle* reversed*. During the examination of the calculi in this Collection, several concretions have been found consisting almost entirely of the ellagic acid of Braconnot.

Ellagic acid calculi are generally of an ovoid figure; their outer surface is smooth, polished, and of a deep olive or greenish brown colour; internally they are brown; they are made up of thin concentric layers, which in some cases adhere so slightly together, as to cause the calculus to fall to pieces on attempting to divide it with a saw. When the outer layers of these calculi are removed, the exposed surface readily acquires a high polish by slight friction, and when cut or scraped they assume a waxy lustre. These calculi invariably contain some foreign body as their nucleus, which is generally a small twig or seed.

The chemical characters of the constituent of these calculi agree sc exactly with those of ellagic acid procured from the infusion of gall-nuts, as to leave no doubt of their being composed principally of that substance. When heated they do not fuse, but emit a slight balsamic odour and partially sublime; if more highly heated they catch fire, burn with a low flame, give off the smell of burn-

* *Ann. de Chim. et de Phys.* ix. 187.

ing wood, and leave behind a carbonaceous ash. If the powder of the calculus be heated in a glass tube a yellow sublimate is produced, which condenses in the form of long spear-shaped crystals of a yellow colour, with a shade of green. These crystals do not differ in their chemical habitudes from the powder of the calculus, and they are identical in shape and appearance with those procured from the ellagic acid of the gall-nut when similarly treated. When the calculus is reduced to powder and diffused through water, several days elapse before the whole of the powder is deposited, and the water remains opalescent even for weeks. It is also difficult to separate the powder by filtration, as the liquid passes turbid for some time.

Ellagic acid calculi easily dissolve, with the exception of a few flocks, in a cold solution of caustic potass or soda. The solution is of a deep brownish red colour, with a shade of green ; when the ellagic acid is, however, freed from some extractive or colouring matter with which it is generally mixed in the calculus, the solution is of so deep a yellow as to appear red when viewed in bulk. Muriatic acid throws down from the potass solution a greenish, buff-coloured powder, while the supernatant liquor is of a light red colour. If the precipitate be examined by the microscope, it is seen to consist of small thread-like particles, generally blunt, but sometimes tapering at their extremities, and which are occasionally twisted or curved, especially if the solution from which they were thrown down was hot: they are not transparent, and can scarcely be termed crystals.

When the potass solution is exposed to the air, oxygen and carbonic acid are absorbed, the solution becomes much darker-coloured, and a silky greenish yellow precipitate is deposited, consisting of ellagate of potass. This precipitate appears under the microscope as thin rectangular plates, frequently arranged in stellate groups. If a current of carbonic acid is passed through the solution, a buff-coloured precipitate of ellagate of potass is thrown down, while the supernatant liquid remains of a dark reddish colour.

Ellagic acid calculi are very sparingly soluble in solution of ammonia; the liquid acquires a yellow colour, which on exposure to the air becomes brown and turbid. The small quantity of ellagic acid dissolved is precipitated by an acid.

Concentrated sulphuric acid readily dissolves these calculi when assisted by a gentle heat. The solution is of a greenish brown colour, and is precipitated by

dilution with water. The precipitate has the form of minute prisms arranged in stellate groups; the extremities of some of the prisms are blunt, others are pointed.

When mixed with nitric acid, the ellagic acid calculus dissolves. If the acid be strong or slightly warmed, effervescence takes place, nitrous fumes are given off, and a solution is produced of a beautiful pink-red colour, similar to that produced by the action of nitric acid upon uric acid. The red colour quickly disappears upon standing; on being heated, a deep yellow solution remains, from which crystals of oxalic acid may be obtained by evaporation. Ammonia added to the solution causes it to assume a red colour, but does not render it turbid.

The ellagic acid is best obtained from these calculi by dissolving the powdered calculus in a weak solution of caustic potass, and transmitting through it a current of carbonic acid. The precipitate which falls is to be digested in diluted muriatic acid, by which the potass is removed, and tolerably pure ellagic acid remains. During the whole of the operation great care must be taken to prevent the contact of atmospheric air, for when dissolved in alkaline liquids, ellagic is quickly converted into a species of ulmic acid. It is not improbable that catechuic acid is sometimes present in these calculi.

This species of intestinal concretion appears to have been first examined by Fourcroy and Vauquelin, and is included in their class of *resinous* Bezoars*. It was shortly afterwards examined by Berthollet, and subsequently by other chemists, all of whom failed in deciding upon its true nature; even so recently as 1843 this calculus was described by M. Lippowitz as consisting of a peculiar organic acid, for which he proposed the name of Bezoaric acid†.

The concretions analysed by Berthollet, and of the properties of which he has given a very accurate account, had been presented to the Emperor Napoleon by the Shah of Persia. They were of a greenish brown colour externally, and brown within; they had an oval figure, and their surface was highly polished; they

* "La seconde variété d'une couleur brune ou violacée, sans saveur amère, presque insoluble dans l'alcohol, entièrement soluble dans les alcalis, donnant dans cette dernière dissolution une liqueur qui devient rouge purpurine, lorsqu'elle s'épaissit et se sèche à l'air: fournissant à la distillation un sublimé concret, jaune, d'une saveur et d'une couleur de suie insoluble dans l'eau et dans l'alcohol."—*Annales du Muséum National*, tom. iv. 334.

† Simon's *Beiträge zur Phys. und Pathol. Chemie und Mikroskopie*, B. i. 463.

were formed of irregular concentric layers, and in the centre of all of them was some vegetable matter; their sp. gr. = 1·463*. They were regarded by Berthollet as consisting of the woody fibre (*lignin*) of the food of the animal, and he conjectures that they must have been taken from the stomach, on account of the little alteration which the vegetable matters that formed their nucleus had undergone.

The constituent of the ellagic acid calculus is likewise described by John under the name of *Bezoarstoff* †; and Leopold Gmelin thinks it probable that the calculi examined by John were identical in composition with those analysed by Berthollet ‡, and that they consisted of a species of ulmin arising from the decomposition of woody fibre or lignin.

From the descriptions which Tavernier, Kœmpfer, and other Oriental travellers have given of the Oriental Bezoar, corroborated by the analyses of Fourcroy and Berthollet, there is no doubt that it is identical with the ellagic acid concretion above described. The signs by which a true Oriental Bezoar might be distinguished were, according to Tavernier, by steeping it in hot water, and observing whether the liquid became coloured, or the stone lost in weight. If either of these occurred, the stone was to be regarded as fictitious: but the best test was to apply a red-hot iron wire to the calculus, when, if it melted and permitted the iron to enter, it was certainly fictitious. Another test consisted in smearing a piece of paper with chalk, and rubbing the calculus over it. The genuine stone always left a greenish mark. All these criteria would be fulfilled by the ellagic acid calculus, but by none of the other species.

This species of concretion was the most valued of the Bezoars, and is denominated by Kœmpfer the "verus et pretiosus *Pasahr*," from which word, by a corruption of sound, he believes the word Bezoar to have been derived.

With regard to the origin of this concretion, we have the fullest and most satisfactory evidence. W. Methold, Fryer, Tavernier and Kœmpfer all agree that it is taken most frequently from the alimentary canal of a species of wild goat termed *Pasen* by the Persians, which inhabits the mountainous ridges in Persia, particularly in the province of Chorasaan or Chorasmia. Tavernier states that they also come from some parts of the kingdom of Golconda. The account as to the exact situation of the stone is however not so clear.

* *Mémoires de la Société d'Arcueil*, tom. ii. p. 448.

† *Chem. Schr.* iii. 38.

‡ *Handbuch der Chemie*, B. ii. S. 828, 1488.

Most writers indicate the maw or stomach: Kœmpfer says it is found in the pylorus, "sive productior quarti, quem vocant ventriculi fundus *," and that the natives are in the habit of ascertaining how many stones are contained in the stomach by feeling through the parietes of the abdomen, the value of the animal being considerably enhanced by their presence. When recently taken from the animal, they are said to be somewhat soft, or of the consistence of a hard-boiled egg, and that in order to preserve them it was customary to place them in the mouth, and retain them there until they acquired greater hardness.

The Oriental Bezoar was not however confined to the wild goats, or to the ruminant tribes, as the *Pedra Bugia* or Ape stone also consists of ellagic acid. These concretions were held in higher esteem than those from the Goat, and were generally included, for the sake of preserving them, in a small cavity scooped out of two portions of a very light wood, which were held together by hoops wove from the twigs of the Rotang cane. There is in the Museum a specimen preserved in this manner. Kœmpfer informs us that they were found in a species of Ape termed Antar by the Mongols, which he believes to be the *Babianum cynocephalum*. The composition of these concretions renders their origin no longer a matter of uncertainty, and confirms, in a very remarkable manner, the statements of Tavernier and Kœmpfer, that they are derived from the juices of the plants on which the animals fed.

Q. *Ellagic Acid.*

Q 1. A large and very fine specimen of the true Oriental Bezoar. This calculus measures two inches and three quarters in length, and rather more than two inches and a half in breadth. Its exterior is of a deep rich brown colour, and is highly polished. It is made up of thin concentric layers surrounding a piece of wood; immediately around the nucleus is a softer unlaminated portion, which consists of the matter of the calculus mixed with a few vegetable hairs. From its large size and regular figure, this calculus must have been of very considerable value in Persia, from

* *Op. cit.* p. 400.

which country it was most probably brought. It consists of ellagic acid mixed with some extractive and colouring matter. *Hunterian.*

2. An ellagic acid calculus, similar in composition, colour and lustre to the preceding specimen, but it is much smaller, and has somewhat of a reniform figure. Its nucleus consists of an almond-shaped succulent fruit, the skin of which still remains. This concretion was purchased at the sale of the Portland collection in 1786, and was described as "a fine Oriental Bezoar." Vide Plate XVI. figs. 1, 2. *Hunterian.*

3. A nearly similar specimen, the nucleus of which is lost. This calculus has been soaked in linseed oil, in order to keep its layers together. *Hunterian.*

4. A small oval concretion, undivided. Its exterior is highly polished, and is of an olive-brown colour. *Hunterian.*

5. A section of a large Oriental Bezoar, the layers of which adhere together very slightly. Its nucleus is lost, but has evidently been a seed, resembling in appearance a Tonquin bean. *Hunterian.*

6. An undivided Oriental Bezoar of an oblong figure, slightly constricted in the middle: a portion of its outer layers has been removed in order to show the colour of its interior. *Hunterian.*

7. An ellagic acid calculus, similar in figure to the preceding specimen. It has a piece of twig for its nucleus. "From a Goat." *Hunterian.*

8. A nearly similar specimen, likewise "from a Goat." It has a piece of grass for its nucleus. *Hunterian.*

9. An Oriental Bezoar, which has been divided transversely, and its nucleus exposed, in order to show that the calculus has been formed on a small twig, having a leaf-bud at its extremity. *Hunterian.*

10. An oblong Oriental Bezoar, having a piece of wood for its nucleus. *Hunterian.*

11. A nearly similar concretion, undivided; its exterior is of a rich reddish brown colour. *Hunterian.*

12. Three small ellagic acid calculi. Their exterior is of an olive-green colour, and they have a flattened oval figure. One of these calculi has been broken across, and exhibits the remains of a seed as its nucleus.
Hunterian.

13. Two small irregularly-shaped concretions, one of which has been broken across. They consist principally of ellagic acid; the broken calculus has a small twig for its nucleus. *Hunterian.*

14. A small reniform concretion, consisting principally of ellagic acid. It has been divided transversely, and exhibits a very perfect date-seed for its nucleus. The convex side of the calculus is marked by a groove corresponding to that of the seed. In the Sloanian MS. Catalogue it was described as an "East Indian Bezoar, with a centre in it which rattles like an Eagle stone." *British Museum.*

15. Portions of some small "Oriental Bezoars with a straw" (or some other vegetable fibre) "for their nucleus."—*Sloanian MS. Catalogue.*
British Museum.

16. A small irregularly-shaped calculus, consisting principally of ellagic acid. It had the following memorandum in the Sloanian MS. Catalogue:—"Oriental Bezoar from Suratte. Thevenot edit. 1696, p. 20 of Franc Pelsart. Bezoar d'Orient, Biron, p. 191. The best is found with the Tartars of Usbek. The animal is called Bazard, from whence comes by corruption the word Bezoar." *British Museum.*

17. Three small Oriental Bezoars. The nucleus of one apparently consists of the seed of a species of *Tribulus*. Described in the Sloanian MS. Catalogue as "an East Indian Bezoar." *British Museum.*

18. "A Monkey Bezoar, or true East India Bezoar, from the Goat; of an oblong shape, with a long straw or some such like substance in its center; sett, as they generally are for preservation, in a piece of what is called *Lignum lævissimum*, the pulp or medulla of which appears to resemble the common elder."—*Sloanian MS. Catalogue.* Kœmpfer, in his *Amœnitates Exoticæ*, Fasciculus ii. p. 396, has given a drawing of one

of these calculi preserved in the above manner. He states that the calculi are most frequently found in the Dog-headed Baboon, and were most highly valued. The cavity in which the above specimen is preserved is scooped out of the solid wood and lined with raw cotton. It consists of ellagic acid, and has a piece of grass for its nucleus. Vide Plate XVI. fig. 3. *British Museum.*

19. A section of "an East Indian Bezoar, weighing three ounces, two drachms and two scruples. From Mr. Vanhuffe."—*Sloanian MS. Catalogue.* This calculus is exceedingly brittle. It consists almost wholly of ellagic acid, and has a minute nucleus of vegetable fibre. *British Museum.*

CALCULI CONSISTING OF RESINO-BEZOARDIC ACID. (RÉSINE ANIMALE BEZOARDIQUE, *Fourcroy and Vauquelin*: LITHOFELLINSAURE, *Goëbel*: THE OCCIDENTAL BEZOAR.

The concretions to which the above names have been applied, are readily distinguished from all others by possessing the easy fusibility and general characters of a resin. In the Sloanian and Hunterian MSS. these concretions were described as "*false West Indian Bezoars,*" on the supposition that they were artificial compounds. Their composition, however, and the finely laminated structure they possess, which it would be almost impossible to imitate by art, clearly show that they are genuine Bezoars.

Resino-bezoardic acid calculi are usually of an oval figure. Their external surface is smooth and polished, and has generally a greenish yellow, green, or a light brown colour. They are made up of thin concentric layers, which are frequently of a deeper tint than the exterior. In the centre of the calculus some foreign body is invariably found which forms the nucleus. These calculi are exceedingly brittle; the fracture is conchoidal, and has a resinous lustre. They vary considerably in size, but are usually larger than the ellagic acid species. One specimen in the Museum measures nearly ten inches in circumference. They melt like resin in the flame of a candle, and when more highly heated, give off white vapours which have an aromatic odour, catch fire, burn with a brilliant flame, and leave behind a small shining carbonaceous ash.

Resino-bezoardic acid calculi readily dissolve in alcohol, with the exception of a small quantity of flocculent matter. The alcoholic solution varies in colour in different calculi, but is usually of a red or greenish red tint. The solution gradually deposits small crystals, which, when examined by the microscope, are seen to consist of low six-sided prisms with flattened extremities. When the alcoholic solution is mixed with water, the resin is thrown down. The precipitate appears under the microscope in the form of small crystalline tufts.

Digested in solution of potass these calculi readily dissolve, the solution is of a brownish green colour, and when neutralized by an acid, a thick curdy precipitate is produced, which by agitation adheres together and while warm may be kneaded between the fingers or drawn into threads like cobbler's-wax. The viscidity of this precipitate is owing to another resinous matter which the calculi contain; for the pure resino-bezoardic acid similarly treated forms an amorphous precipitate which cannot be made to adhere together. They dissolve in solutions of ammonia and its carbonate. In concentrated sulphuric acid they also dissolve. The solution is of a red colour, and is rendered turbid by the addition of water. The precipitate is not crystalline, like that from its solution in alcohol, but consists of minute transparent yellow particles. Nitric acid acts with energy upon these calculi, nitrous acid is evolved, and a light red solution is formed, which quickly becomes yellow.

The concretions described by Kœmpfer under the name of *Coagulum Resinosum Bezoarticum* are identical in composition with these calculi; for he says that the Swedish ambassador, on his departure from Ispahan, purchased some specimens, which, when thrown upon burning coals, melted and gave out an aromatic odour like that of colophony or olibanum. He likewise states that they were termed in Persia *Lapis Bezoar Occidentalis*, on account of their similarity to the concretions brought from South America, and which, according to Monardes, were taken from the wild goats of Persia. A figure of the Occidental Bezoar is given in the work of Clusius, which is quite characteristic of the resino-bezoardic acid concretion. It is therefore probable that the true Occidental Bezoar was a resinous concretion, although the same term was often applied to other concretions.

The chemical characters of these concretions appear to have been first in-

vestigated by Fourcroy and Vauquelin. Their account is very slight and imperfect, but is accompanied by a very accurate drawing of a fragment of one of these calculi. Fourcroy states that they are taken from some unknown species of Asiatic or African animals, and rightly conjectures that they are formed from the resinous juices of the plants on which these animals feed*. It is remarkable that since the time of Fourcroy no other investigation of these singular concretions should have been made until the year 1841, when M. Goëbel found a calculus in the Zoological Museum at Dorpat, which was described as "*a gall-stone consisting of concentric layers*," but had no history. From the results of his experiments on this calculus, M. Goëbel concluded that it was a new species of gall-stone consisting of a peculiar acid, to which he gave the name of *lithofellinic acid*, mixed with a small quantity of albumen and of the yellow colouring matter of the bile†.

Shortly after a similar calculus was found by Professor Wöhler among a collection of pathological specimens at Göttingen. This calculus was also without any history, but from its colour and from its containing matters similar to the colouring matter of the bile, it was conjectured to be a gall-stone from some large foreign animal, although the probability of its belonging to the class of Bezoars is also admitted. It weighed 643 grains, was of an ovate figure, and had a light brownish green colour with a waxy lustre. It consisted of a great number of thin concentric layers which easily separated from each other, and were alternately of a lighter or darker colour, but had not the slightest trace of a crystalline structure. Its nucleus was formed by a thick brown substance, which in most of its properties resembled the rest of the stone, but differed from it in being only partially fusible, and leaving on ignition a yellow alkaline ash, which contained phosphate and carbonate of lime with traces of peroxide of iron‡.

The composition of this species of calculus was carefully examined very shortly after commencing the examination of this Collection, and it was described as an intestinal concretion, in a report addressed to the Museum Committee in January 1841. Subsequent examination has confirmed the former

* *Annales du Muséum National*, tom. iv.

† *Annalen der Chemie und Pharmacie*, B. xxxix.

‡ Poggendorff's *Ann. der Phys. und Chem.*

opinion as to their origin, and they have been arranged with intestinal concretions for the following reasons :—

First. They resemble all other concretions which are known to be found in the intestines by having a foreign body for their nucleus.

Secondly. They sometimes attain a very large size, quite incompatible with the notion of their being biliary concretions. There is one specimen in this collection which measures three inches and a half in length, and the same in its greatest diameter. This calculus is of a rude triangular figure, and has evidently been accompanied by other calculi, as both of its extremities have depressed surfaces. Another is four inches in length by three in breadth.

Thirdly. That they are not derived from any of the natural or altered constituents of the bile which have concreted in the intestine, is proved by their
...table resin, which is incapable of crystallizing, besides other
... may be stated that no unequivocal
... intestine has hitherto been

... these concretions it has been
...table resin, which is charac-
...risms; that it is accompanied
...aining volatile oil; that in ad-
...es, as colouring and extractive
...ble to determine, but which are
... of these calculi with the litho-
... shown by the similarity of their
...rate drawing which accompanies
...e nature of the colouring matter,
...rom the bile. In all the calculi
...ould be obtained of the presence
...y Prof. Goëbel in the concretion
...n. It is probably only an accidental
..., however, not infrequently present
... the presence of its colouring matter
... the biliary origin of these calculi.
...d to ultimate analysis by Drs. Ettling

and Will, and also by Prof. Wöhler. Their results are shown in the following table:—

	Ettling and Will. By Analysis.		By Calculation.	Ats.
Carbon	71·19	70·80	. . 71·43	= 42
Hydrogen	10·85	10·78	. . 10·63	= 76
Oxygen	17·96	18·42	. . 17·94	= 8*
	100	100	100	

	Wöhler. By Analysis.	By Calculation.	Ats.
Carbon	70·83	. . 70·83	= 40
Hydrogen	10·60	. . 10·48	= 72
Oxygen	18·57	. . 18·69	= 8†
	100	100	

The composition of the crystallized acid is therefore regarded by Drs. Ettling and Will as represented by the formula $C_{42}H_{74}O_7+HO$. Prof. Wöhler represents it as $C_{40}H_{70}O_7+HO$, and believes this formula to be the most correct, since it corresponds with that of the other crystalline resins in the number of atoms of carbon.

R. *Resino-bezoardic Acid.*

R 1. A section of a large resino-bezoardic calculus. It measures three inches in length by two and a quarter in breadth, and is composed of thin concentric layers of a greenish-brown colour, surrounding a small twig. *Hunterian.*

R 2. An oblong concretion, similar in appearance and composition to the preceding specimen. It measures nearly three and a half inches in length by two and a quarter in breadth. Its nucleus consists of a small mass of vegetable hairs, cellular tissue, spiral vessels, and other vegetable remains. *Hunterian.*

R 3. An oval resino-bezoardic calculus, the nucleus of which is lost, but has apparently been some seed. *Hunterian.*

R 4. An undivided concretion, of a nearly circular flattened figure. It consists almost entirely of resino-bezoardic acid. *Hunterian.*

R 5. An entire resino-bezoardic acid calculus, of an irregularly rounded figure. *Hunterian.*

* *Ann. der Chem. und Pharm.*, xxxix. 242.

† Poggendorff's *Ann. der Phys. und Chem.*, liv. 259.

℞ 6. A small entire resino-bezoardic acid calculus, of an irregular oval figure. *Hunterian.*

℞ 7. A resino-bezoardic acid calculus, of a regular oval figure, about an inch and three quarters in length. It is composed of concentric layers, varying in tint from dark green to light brown, surrounding what appears to be the remains of a seed. *Hunterian.*

℞ 8. A longitudinal section of a small resino-bezoardic acid calculus, the nucleus of which has been lost. "Lap. Bezoar Coromandel." *Hunterian.*

℞ 9. A flattened oval calculus, composed of concentric layers of resino-bezoardic acid, varying in colour from light brown to dark green; deposited around a small mass of long vegetable hairs. *Hunterian.*

℞ 10. A flattened oval calculus, having a piece of quartz for its nucleus. It consists of resino-bezoardic acid, is of a light brown colour throughout, and differs from the other calculi in having a slightly radiated structure. *Hunterian.*

℞ 11. A large calculus, of an oval figure, which measures nearly four inches in length by nearly three inches in breadth. It consists of resino-bezoardic acid, and has a mass of fine brown animal hairs for its nucleus. *Hunterian.*

℞ 12. An oblong resino-bezoardic acid calculus, having a piece of twig for its nucleus. Its exterior is speckled green and brown.

℞ 13. A fragment of a very compact resino-bezoardic acid calculus. *Hunterian.*

℞ 14. A small undivided calculus, of an oblong figure. *Hunterian.*

℞ 15. A similar calculus, of a rounded figure, flattened on one side. Described in the Sloanian MS. Catalogue as "A false West Indian Bezoar. Lapis Bezoar de Coromandel Seba." *British Museum.*

℞ 16. A small flattened pyriform calculus, consisting of resino-bezoardic acid. Its nucleus is formed by a small twig, immediately surrounding which is

a soft mass, consisting of the substance of the calculus mixed with vegetable hairs. This calculus was described in the Sloanian MS. Catalogue as "A false Bezoar from Turkey. From Mr. Pearle."

British Museum.

R 17. A section of a regular oval calculus composed of concentric layers of resino-bezoardic acid surrounding a date-seed. *British Museum.*

R 18. A section of a flattened nearly circular calculus, consisting of resino-bezoardic acid, deposited around a mass composed chiefly of animal hairs. Described in the Sloanian MS. Catalogue as "Bezoar occidental."

British Museum.

R 19. An oblong calculus, similar in composition to the preceding, having a twig for its nucleus. "False occidental Bezoar."—*Sloanian MS. Catalogue.* *British Museum.*

R 20. A nearly globular calculus, considerably broken. Described in the Sloanian MS. Catalogue as "A false bezoar, made of rosin, &c.; it melts with a candle." This calculus is similar in composition to all the preceding specimens, and is doubtless derived from the resinous juices of the plants on which the animal has fed. *British Museum.*

R 21. A section of a resino-bezoardic acid calculus, having a piece of clay for its nucleus. *Presented by W. Clift, Esq.*, 1821.

R 22. A resino-bezoardic acid calculus, which measures three inches and a half in length. It has the form of an irregularly-shaped three-sided prism, with rounded edges, and both its extremities are concave from having been in contact with other concretions. Its nucleus consists of a small mass of vegetable fibre. *Hunterian.*

R 23. A section of a small resinous concretion divided transversely, having a date seed in its centre. *British Museum.*

CALCULI CONSISTING OF PHOSPHATE OF MAGNESIA AND AMMONIA. (TRIPLE PHOSPHATE CALCULUS).

This species of calculus forms the ordinary intestinal concretion of Horses. It is usually found in the stomach, cæcum, or other part of the large intestines, and frequently attains an enormous size. A specimen in this Collection weighs above seventeen pounds, and measures two feet three inches in circumference, and there are several others of scarcely inferior dimensions.

The triple phosphate calculus is easily recognized, when broken, by its crystalline structure; it appears to be made up of broad crystalline plates, which radiate from the centre to the circumference of the calculus. When more closely examined, however, it is seen to possess a laminated structure, the concentric layers being so thin and closely arranged together, that upwards of two hundred have been counted by Mr. J. Quekett in the space of an inch: the laminated structure is most apparent when the calculus is sawn through. The external surface of these calculi is either smooth or crystalline, and of a light brown or grey colour: their interior is generally deep brown, and the fractured surface sometimes exhibits an iridescent appearance, like that of Labrador felspar: thin fragments of the calculus are semi-transparent, but by exposure to the air lose part of their water of crystallization and become opake. This fact is frequently to be observed on the surface of the concretions, which appear coated by a white earthy crust*. These concretions have almost invariably some foreign body for their nucleus, the figure of which determines the general form of the calculus; as they increase in size they always assume more or less of a rounded figure.

In their chemical composition triple phosphate calculi are for the most part very pure. Small quantities of phosphate of lime are generally to be detected, and this salt sometimes amounts to nearly 20 per cent. They also contain a large quantity of animal matter,—an extractive matter, to which the brown colour of the calculus is owing, muriate of soda, and various alkaline salts derived from the intestinal juices. The animal matter resembles that of all other concretions, and separates in concentric laminæ when the calculus is dissolved in an acid. In the more impure varieties, grains of sand, hay and straw

* By some authors this white crust has been described as consisting of sulphate of magnesia and ammonia. In all the specimens that have been examined, it consisted merely of the effloresced triple phosphate.

are frequently found imbedded in the calculus; and there is one specimen in the Museum which contains an entire layer of vegetable hairs.

When heated before the blowpipe, triple phosphate calculi lose their water and ammonia, become white and opake, and by a powerful heat may be fused into au opake enamel, consisting of diphosphate of magnesia. They readily dissolve in the weakest acids, and from the solution ammonia precipitates the salt unchanged in the form of a crystalline powder.

When boiled with solution of potass, ammonia is freely evolved.

Numerous descriptions of these calculi are to be found in the 'Transactions of the Royal Society' and other scientific works. Their composition was first ascertained by Fourcroy and by Bartholdi of Strasburg about the same time. A specimen analysed by Klaproth was found to consist of phosphoric acid 28·, magnesia 17·, ammonia 7·, animal matter 1·, water 47·*.

With regard to the origin of triple phosphate calculi, most authors agree that they are formed from the phosphate of magnesia contained in wheat, oats, hay, &c., and this opinion derives confirmation from the circumstance, that they occur most frequently in millers and brewers' horses which are fed on grains and bran, substances known to contain a much larger proportion of magnesian salts than other vegetable matters.

𝕾. *Phosphate of Magnesia and Ammonia.*

𝕾 1. The two halves of a large calculus, consisting principally of phosphate of magnesia and ammonia. It has a piece of flint for its nucleus, and was "taken out of the stomach of a miller's Horse at Berkhampstead. From Dr. Woodward's Collection."—*Sloanian MS. Catalogue.*

British Museum.

𝕾 2. An intestinal concretion of a nearly globular form, which measures six inches and three quarters in diameter. From the Horse. It consists of phosphate of magnesia and ammonia, and contains midway between its

* *Chemische Abhandlungen*, B. vi. 213.

centre and exterior a layer of about half an inch in thickness of the hairs of the oat. *Presented by Sir W. Blizard.*

3. A very large heart-shaped concretion, which measures two feet three inches in its greatest circumference, and weighs nearly seventeen pounds avoirdupois. It is composed throughout of phosphate of magnesia and ammonia, mixed with some phosphate of lime. Its external surface is beautifully crystalline, and a small piece of flint forms the nucleus. *Hunterian.*

4. An undivided concretion, of an oblate spheroidal figure. It measures two feet four inches in its greater circumference, and weighs nearly eighteen pounds. Its external surface is quite smooth. *Hunterian.*

5. A large cylindrical-shaped concretion having smooth flattened surfaces at each extremity. It measures seven inches in length, and contains an iron nail in its centre. Composition similar to the preceding. *Hunterian.*

6. A large triple phosphate calculus divided. *Hunterian.*

7. A nearly spherical concretion, measuring twenty-two inches in circumference. It consists of crystalline triple phosphate, and has contained vegetable matter. *Hunterian.*

8. A large intestinal concretion lobulated on its exterior. It consists of impure triple phosphate. *Hunterian.*

9. An intestinal concretion of nearly a globular form, measuring above six inches in diameter. The concentric arrangement of the layers and the radiated structure of the triple phosphate calculus are well shown in this specimen. *Hunterian.*

10. A section of a similar but larger calculus. Its exterior is partly coated by a crystalline crust of the triple phosphate. *Hunterian.*

11. A similar calculus of a rude conical figure, with a quadrangular base. *Purchased,* 1828.

12. An oval concretion, consisting of compact triple phosphate. *Hunterian.*

13. A cubical-shaped calculus, consisting of compact triple phosphate. *Hunterian.*

14. A compact flattened calculus from the intestinal canal of the Horse. *Hunterian.*

15. An oval calculus, consisting of triple phosphate deposited upon a small nail. Its exterior is smooth but crystalline. *Hunterian.*

16. An oval concretion, the exterior of which is singularly lobulated. Triple phosphate. *Hunterian.*

17. A cylindrical calculus, having depressed polished surfaces at each extremity, from having been in contact with other stones. It consists of triple phosphate, which has been deposited around a horse-shoe nail. *Hunterian.*

18. A flattened concretion, similar in composition to the preceding species. *Hunterian.*

19.
20.
21.
22. Four triple-phosphate concretions, having a rude tetrahedric figure, with unequal sides. *Hunterian.*

23. Four triple phosphate concretions, taken "from the alimentary canal of a Horse, which was opened at Messrs. Tattersall's, August 1789."

No. 1. The smallest, of a flattened triangular figure, was taken out of the stomach.

Nos. 2 and 3. Of a tetrahedric figure, were taken from the colon.

No. 4. Of a cylindrical shape, flattened at both ends, was taken from the rectum, at about eighteen inches from the anus. *Hunterian.*

24. Four intestinal concretions taken from a Horse. They are similar in form and composition to the preceding specimens, but are much smaller. *Hunterian.*

25. Four large intestinal concretions, which were doubtless taken from the Horse. One of these concretions is of a flattened circular figure, having a deep circular excavation on one of its sides, which has probably been filled with excrement. *Hunterian.*

26. A large triple phosphate calculus, of a rounded cubical figure. It was accompanied by a memorandum in Dutch, stating it to have been taken from a Japanese wild Horse. *Hunterian.*

27. A globular triple phosphate concretion, from the intestinal canal of a Horse. *Presented by Wm. Gaitskell, Esq.*, 1810.

28. A section of a large triple phosphate calculus, polished. *British Museum.*

29. A similar calculus, of large size and of a rude cubic figure, with rounded edges and angles. It has a nail for its nucleus. *British Museum.*

30. The two halves of a large and singularly-shaped intestinal calculus, said to be from the stomach of a Horse. This concretion is of an oblong figure, and about its middle is a deep groove, which gives it the appearance of being formed of two unequally-sized calculi united together. Its extremities are smooth and polished, and the exterior is in many places deeply pitted. Phosphate of magnesia and ammonia deposited around a large nail. *Presented by Dr. Power*, 1821.

31. An oval triple phosphate concretion, having a smooth external surface. *Hunterian.*

32. A spherical concretion, consisting of crystalline triple phosphate, and having a very dark-coloured granular exterior. It has a piece of flint for its nucleus. *Hunterian.*

33. A triple phosphate concretion, of a nearly globular figure. *Hunterian.*

34. An oval concretion, undivided, similar in composition to the preceding specimen. *Hunterian.*

35. A portion of a similar concretion. *Hunterian.*

36.–37. Two small triple phosphate concretions, having a piece of flint in their centres; apparently taken from the same animal. *Hunterian.*

38. A small, triangularly-shaped triple phosphate concretion. *Hunterian.*

39. An oblong concretion, consisting of triple phosphate, and having a horse-shoe nail for its nucleus. *Hunterian.*

40. An egg-shaped triple phosphate calculus. *Hunterian.*

41. A large spherical, triple phosphate calculus, with 112 small concretions. From the intestinal canal of the same horse.
Presented by Sir J. Banks.

42. A very large triple phosphate concretion, of a rounded quadrilateral figure. It has a small fragment of flint for its nucleus.
Hunterian.

43. A smaller calculus, having also a rude quadrilateral figure. It has a nail in its centre. *Hunterian.*

44. A large spherical concretion, said to have been taken from the alimentary canal of an Elephant. It consists of triple phosphate, which at the centre is highly crystalline.
Presented by Wm. Bullock, Esq., 1815.

45. A considerable number of small flattened concretions, taken from the intestinal canal of a Horse. They consist of triple phosphate, and their external surface is eroded, as if partially dissolved.
Presented by Sir Wm. Blizard, 1813.

46. Half a small triple phosphate calculus. *Hunterian.*

47. 48. Small intestinal concretions, consisting of phosphate of magnesia and ammonia, with phosphate of lime. *Hunterian.*

49. Fragments of the exterior of a large intestinal concretion.
Hunterian.

50. A broken triple phosphate calculus. *Hunterian.*

51. The half of a small oval concretion, consisting principally of triple phosphate, deposited around a nail. *Hunterian.*

52. Several small concretions, principally consisting of triple phosphate. Some of them are deposited upon a nucleus of flint, and one upon the head of a brass chair-nail. *Hunterian.*

53. A small broken intestinal calculus, which was "voided by a Horse."—*Sloanian MS. Catalogue.* *British Museum.*

54. A nearly circular triple phosphate calculus, surrounding a piece of iron. *Hunterian.*

55. Twenty-two irregularly-shaped triple phosphate concretions, taken from the intestines of a Horse. The broken surface of some of these concretions presents an iridescent appearance like Labrador felspar. *Presented by Sir Wm. Blizard,* 1807.

56. Triple phosphate calculus, deposited upon a piece of iron. *Hunterian.*

57. An oval-shaped concretion, consisting principally of triple phosphate, deposited upon a nail. The surface of this calculus is eroded in parts as if it had been submitted to the action of an acid. *Hunterian.*

58. The two sections of a compact triple phosphate concretion, having a flint pebble for its nucleus. *Hunterian.*

59. Fragments of an intestinal calculus, consisting of phosphate of magnesia and ammonia, with some phosphate of lime. *Hunterian.*

60. A small flattened oval calculus, from the Horse. *Hunterian.*

61.
62. Two polygonal-shaped concretions, consisting of phosphate of magnesia and ammonia with a little phosphate of lime. Large crystals of the triple phosphate form the centre of each. One of these calculi is figured in Plate XIV. fig 2. *British Museum.*

63. Several small irregularly-shaped triple phosphate concretions, from the colon of a Horse. *Presented by G. Langstaff, Esq.*

64. A very large intestinal calculus, taken from a Horse slaughtered in Cow Cross, Smithfield. It consists partly of triple phosphate and partly of undigested vegetable fibre, principally the setæ of the oat-seed.

Purchased, 1824.

65. A globular triple phosphate calculus, taken from the stomach of a miller's horse. It weighs above seventeen pounds.

Presented by Thomas Cam, Esq., 1845.

CALCULI CONSISTING OF DIPHOSPHATE OF MAGNESIA.

This species of calculus is distinguished from all other concretions by its singularly tuberculated exterior, and by the beautiful appearance of its section, which in variety of tints, transparency and general aspect, closely resembles some kinds of agate. It is made up of semi-transparent layers of various shades of a light-brown or yellow colour, alternating with white opake layers; these are arranged in undulating circles around the nucleus, which usually consists of some vegetable substance: the concentric layers are intersected by crystalline needles radiating from the centre to the circumference of the calculus, and which also vary in colour and transparency. Its exterior is smooth, but highly tuberculated; the tubercles consist of broad crystalline plates lying one over the other. Some of these calculi are exceedingly brittle, and readily separate into concentric layers about a sixth of an inch in thickness: irregular deposits of phosphate of lime are generally to be observed ramifying between the concentric and diverging layers of the calculus, as shown in Plate XIV. fig. 5.

The phosphate of magnesia calculus is of much rarer occurrence than either the triple phosphate or the phosphate of lime concretion. It is generally of a globular figure, and seldom exceeds three inches in diameter: it usually contains a small quantity of phosphate of lime, to which the whiteness of its layers is probably owing. Animal matter is always present, but apparently in smaller quantity than in most other intestinal calculi.

When heated before the blowpipe this calculus becomes white and opake, chars, and by a very great heat may be fused into a white enamel. It readily dissolves in the diluted acids, with the exception of a small quantity of animal matter, and the addition of ammonia causes an abundant precipitate of phosphate

of magnesia and ammonia. Fourcroy and Vauquelin appear to have been the only chemists who have examined this concretion; their description is very short and imperfect, and they did not ascertain the proportion of its constituents *. 19·52 grains of a specimen in this collection, after being heated red-hot, dissolved in muriatic acid, and freed from lime by the addition of oxalate of ammonia, gave with ammonia a crystalline precipitate of triple phosphate which when calcined weighed 17·24 grains. The same calculus was found to consist per cent. of—

Diphosphate of magnesia	56·86
Diphosphate of lime with a trace of the oxides of manganese and iron	7·00
Water and animal matter	35·62
Loss	00·52
	100·00

As part of the water belongs to the diphosphate of lime, which as will be shown hereafter, contains 4 equivalents of water, 1·54 of water should be subtracted from 35·62; and if the animal matter be estimated at 1· per cent. the quantity of water combined with the phosphate of magnesia will be reduced to 33·08, which is nearly in the atomic proportion of 7 to 1. Consequently these concretions consist of 1 atom of diphosphate of magnesia combined with 7 atoms of water †. When the calculus is dried at a temperature of 212°, 5 atoms of water are driven off; by a red heat the whole is expelled.

From what animals these concretions were taken we have not been able to obtain the slightest information. Many of the specimens were described in the Hunterian and Sloanian MSS. as Rhinoceros Bezoars, but Sir Anthony Carlisle assured Mr. Clift that there was not the slightest reason for supposing that they were taken from that animal, and that they were so called simply on account of the resemblance which their scaly and tuberculated exterior was supposed to bear to the folds of the skin of the Rhinoceros.

* *Annales du Muséum National*, tom. iv.

† The phosphate of magnesia which is thrown down on mixing saturated solutions of phosphate of soda and sulphate of magnesia contains 14 equivalents of water.—Berzelius, *Lehrbuch der Chemie*.

C. *Diphosphate of Magnesia.*

C 1. A large globular calculus, consisting principally of diphosphate of magnesia. Described in the Sloanian MS. Catalogue as a Rhinoceros Bezoar. Its analysis is given at p. 249. *British Museum.*

C 2. A similar calculus divided and polished; it is figured in Plate XIV. fig. 3, and has the compact structure, semi-transparency, and beautifully variegated appearance of some varieties of agate. *Hunterian.*

C 3. A nearly spherical concretion undivided, consisting of diphosphate of magnesia; its surface is very irregular, from the deposition of broad scaly-looking masses. *Hunterian.*

C 4. An oblong concretion, consisting of concentric layers of diphosphate of magnesia surrounding a piece of twig: described in the Hunterian MS. as a "Rhinoceros Bezoar." *Hunterian.*

C 5. An intestinal concretion, composed of diphosphate of magnesia surrounding two excentric nuclei of phosphate of lime upon a piece of wood; its exterior is covered with small flattened tubercles. *Hunterian.*

C 6. A very irregularly-shaped concretion composed of diphosphate of magnesia deposited upon a piece of leather or horn; its surface is slightly tuberculated. "Rhinoceros Bezoar."—*Sloanian MS. Catalogue.* *British Museum.*

C 7. An undivided calculus, the exterior of which exhibits in a very marked manner the scaly appearance characteristic of the diphosphate of magnesia calculus. *British Museum.*

C 8. A similar calculus divided; its nucleus consists of an acorn. *British Museum.*

C 9. A "Rhinoceros Bezoar," the nucleus of which is composed of the remains of some seed. *British Museum.*

𝕮 10. A section of an intestinal concretion, consisting of diphosphate of magnesia surrounding a piece of pebble. *British Museum.*

𝕮 11. A large diphosphate of magnesia concretion, the nucleus of which consists of some decayed vegetable matter; it is of an irregular rounded form, and measures about two inches and a half in diameter. "Rhinoceros Bezoar, with very large knobs. From Dr. Waldo."—*Sloanian MS. Catalogue.* *British Museum.*

𝕮 12. Section of a similar calculus, the nucleus of which is lost. *British Museum.*

𝕮 13. An undivided calculus, of a nearly globular figure, consisting of diphosphate of magnesia. *British Museum.*

𝕮 14. A section of a similar calculus, having a piece of pebble in its centre. Its exterior is figured in Plate XIV. fig. 4. *British Museum.*

𝕮 15. A section of a calculus, consisting of diphosphate of magnesia. *Presented by W. T. Brande, Esq.*, 1843.

CALCULI CONSISTING OF DIPHOSPHATE OF LIME.

The description which Dr. Wollaston has given of the external characters of the bone-earth urinary calculus, will equally apply to the following intestinal concretions.

These concretions are usually of an oval figure, their exterior is of a light brown colour, smooth, and sometimes polished; when divided they present a regular laminated structure, the layers usually adhering so slightly to each other that they are readily separated into concentric crusts, which vary in thickness from a twentieth to a quarter of an inch. Each concentric layer is composed of an assemblage of fine crystalline needles, which radiate from the centre to the circumference of the calculus, so as to give it when broken a beautifully striated appearance. This species never attains so large a size as the triple phosphate calculus: the largest specimen in the Museum measures four inches

in length by three and a half across. The nucleus always consists of some foreign body.

Diphosphate of lime calculi fuse with difficulty into an opake white enamel; but if phosphate of magnesia be also present they fuse with much greater ease. They readily dissolve in muriatic and nitric acids: the solution behaves towards reagents precisely like an acid solution of the earth of bones. When diluted and mixed with oxalate of ammonia a precipitate of oxalate of lime takes place; and if the solution be afterwards neutralized by ammonia, in order to throw down any oxalate of lime that might have been dissolved, filtered and then evaporated to dryness, and the dry salt heated to redness in a platina crucible, glacial phosphoric acid is left, which is readily recognised by its solution, previously neutralized by an alkali, affording a yellow precipitate with nitrate of silver and a white precipitate with solutions of lead. The latter precipitate, when fused before the blowpipe, gives a bead which crystallizes on cooling, a property characteristic of phosphate of lead. Water digested with these concretions acquires an acid reaction, and phosphate of lime is found in solution. This circumstance arises from the diphosphate of lime being partially decomposed into an insoluble subphosphate and a soluble superphosphate of lime*. Even when the powder of the calculus is placed upon moistened litmus paper, the paper becomes almost immediately reddened. Fourcroy and Vauquelin, who first described these calculi, noticed the above fact; and as they did not ascertain their exact composition, fell into the error of regarding them as composed of an acid or superphosphate of lime,—"*phosphate acidule de chaux*†."

A well-marked specimen of one of these calculi being submitted to analysis, gave—

Diphosphate of lime	76·60
Diphosphate of magnesia	0·84
Water	21·02
Organic matter	1·42
	99·88

* Diphosphate of lime prepared by adding a solution of phosphate of soda to one of chloride of calcium in excess undergoes a similar decomposition.

† *Annales du Muséum National*, tom. iv.

23·83 grains of the calcined calculus abstracting the small quantity of phosphate of magnesia when dissolved in an acid and precipitated by oxalate of ammonia gave 18·93 of carbonate of lime, which = 23·80 of diphosphate of lime.

21·02 water, and 76·60 diphosphate of lime, are nearly in the proportion of four atoms of water to one of the earthy salt*.

Hence this calculus consists of an atom of diphosphate of lime combined with four atoms of water, and its formula will be $2\ CaO + P_2O_5 + 4\ aq$. It differs therefore from the concretions found in the ureter of the Sturgeon by containing one atom less of water.

The relative proportion of phosphoric acid and lime in these concretions has also been determined by E. A. Scharling, who found that when 1·018 gramme of the calcined calculus were dissolved in muriatic acid, and the solution precipitated by a mixture of sulphuric acid and alcohol, 1·087 gramme of sulphate of lime were thrown down, which are = to 1·0169 of the neutral phosphate of lime†.

These concretions appear to have been most commonly found in animals of the Deer species. In the Sloanian MS. Catalogue they are termed Occidental or West Indian Bezoars. There are however specimens in the Museum brought from Ceylon and the Cape of Good Hope.

A. *Diphosphate of Lime.*

AA 1. An undivided calculus, described in the Sloanian MS. Catalogue as "A very large Occidental Bezoar in the shape of a kidney. Given to me by Mr. Burnett, who had it at Puerto-belo." Its analysis is given at p. 252. *British Museum.*

AA 2. An oblong calculus, taken "from the stomach of La Paca.". This calculus has been divided, and is figured in Plate XV. figs. 5, 6. It consists of diphosphate of lime, water, and organic matter mixed with a smaller

* The quantity of water should be 21·40, but from the calculus containing organic matter its exact determination is difficult. 31·11 grains of the calculus when dry lost by calcination 6·98, which = 22·44 per cent. of water and animal matter destroyed.

† *De Chemicis Calculorum Vesicariorum rationibus.*

proportion of diphosphate of magnesia than in the former specimen. Its section beautifully exhibits the radiated and laminated structure characteristic of these concretions. It has a small twig in its centre.

Presented by William Bullock, Esq., 1813.

𝔄 3. A large irregularly-shaped calculus, precisely similar in structure and composition to the preceding specimens; it has a piece of wood for its nucleus. *Hunterian.*

𝔄 4. A very regular flattened oval calculus. Its nucleus is lost, but has apparently been a nail. *Hunterian.*

𝔄 5. An irregular triangularly-shaped concretion, having a mass of coarse vegetable matter for its nucleus. *Hunterian.*

𝔄 6. Eight irregularly-shaped concretions, described in the Hunterian MS. Catalogue as "Bezoars, South America, said to be from the Deer." *Hunterian.*

𝔄 7. Half of a small diphosphate of lime concretion, broken transversely. *Hunterian.*

𝔄 8. A flattened oval calculus; its exterior is smooth and polished, and its concentric layers have been deposited around two separate nuclei. *Hunterian.*

𝔄 9. Three small undivided diphosphate of lime calculi. *Hunterian.*

𝔄 10. A small kidney-shaped calculus, composed of layers of diphosphate of lime, deposited around two separate nuclei, between which is a small mass of coarse vegetable fibre. *Hunterian.*

𝔄 11. A mass of hay or dried vegetable fibre coated with diphosphate of lime. *Hunterian.*

𝔄 12. A pyramidal calculus with a quadrangular base, having a piece of twig for its nucleus. *Hunterian.*

𝔄 13. A small egg-shaped concretion, having a piece of twig for its nucleus. *Hunterian.*

𝔄 14. A very regular oval-shaped calculus, consisting of diphosphate of lime deposited on a piece of clay; its surface is smooth and polished, and exhibits marks of having been mounted as an amulet. *Hunterian.*

𝔄 15. A small oval calculus, consisting apparently of two separate calculi united together by a subsequent deposit; it contains some vegetable fibre and a piece of wood for its nucleus. *Hunterian.*

𝔄 16. A similar specimen. *Hunterian.*

𝔄 17. A small oval calculus, consisting of diphosphate of lime. *Hunterian.*

𝔄 18. An oblong diphosphate of lime calculus concretion, having a piece of wood for its nucleus. *Hunterian.*

𝔄 19. A large oval, flattened calculus, consisting of diphosphate of lime arranged in radiating fibres and concentric layers around two separate nuclei. *Hunterian.*

𝔄 20. An irregularly-shaped calculus, consisting of concentric layers of diphosphate of lime surrounding a piece of twig. *Hunterian.*

𝔄 21. A large flattened calculus, consisting of diphosphate of lime, surrounding a small nucleus of vegetable fibre. It readily separates into concentric crusts of about a quarter of an inch in thickness. *Hunterian.*

𝔄 22. A flattened, irregularly-shaped calculus, having a piece of mica-slate for its nucleus. *Hunterian.*

𝔄 23. A small oval calculus, which has formed around a piece of twig. *Hunterian.*

𝔄 24. A nearly circular, flattened bezoar, consisting of diphosphate of lime, and having a piece of hæmatite or native oxide of iron in its centre. *Hunterian.*

𝔄 25. A diphosphate of lime calculus, of a very irregular shape, apparently from having been accompanied by other concretions. *Hunterian.*

[illegible] 26. A very irregularly-shaped concretion, composed of diphosphate of lime deposited around a twig. *Hunterian.*

[illegible] 27. An undivided calculus consisting of diphosphate of lime. *Hunterian.*

[illegible] 28. A similar concretion divided, having two separate nuclei. *Hunterian.*

[illegible] 29. A small oval calculus having an irregular nucleus of vegetable fibre and a piece of twig. *Hunterian.*

[illegible] 30. Several small irregularly-shaped concretions, consisting of diphosphate of lime, having small twigs for their nuclei. *Hunterian.*

[illegible] 31. A diphosphate of lime calculus, of a flattened triangular figure. Each of its flattened sides is depressed from having been in contact with other concretions. Its structure is less compact and more earthy than these concretions usually are, but it does not differ from them in composition and contains some phosphate of magnesia. *Hunterian.*

[illegible] 32. A triangular-shaped concretion, the structure of which is earthy, like that of the preceding specimen. It consists principally of diphosphate of lime. *Hunterian.*

[illegible] 33. A small, very compact calculus, having a piece of slate for its nucleus. *Hunterian.*

[illegible] 34. A section of an intestinal concretion, exhibiting in every respect the characters of the diphosphate of lime calculus. Its nucleus consists of a fine twig. *Mus. Leverian.*

[illegible] 35. A diphosphate of lime calculus, having a twig for its nucleus. Described in the Sloanian MS. Catalogue as "A large false bezoar. From Dr. Sam. Brown." *British Museum.*

[illegible] 36. A small oval calculus of diphosphate of lime, surrounding a piece of clay. Described in the Sloanian MS. Catalogue as "Bezoar Cervi." *British Museum.*

[illegible] 37. An egg-shaped calculus, consisting of diphosphate of lime deposited around a siliceous pebble. Described in the Sloanian MS. Catalogue as "A very large white West Indian Bezoar. Bezoar de Guinea. Seba." *British Museum.*

𝔄 38. A large intestinal calculus, of a rude triangular figure, having a twig in its centre. Described in the Sloanian MS. Catalogue as "An Elephant Bezoar, triangular by rubbing against others." *British Museum.*

𝔄 39. An intestinal calculus, consisting of diphosphate of lime; it is of a flattened figure, and has a piece of slate in its centre. This concretion was brought from Patagonia, where it was stated to have been taken from the head of a Lama, and was supposed by the natives to possess the power of relieving fainting when taken in *cold* water.
Presented by H. Miller, Esq.

𝔄 40. A very flat oval calculus, taken out of the stomach of a Deer in the island of Ceylon. It is composed of diphosphate of lime mixed with a little phosphate of magnesia; its structure is less laminated than these calculi usually are. *Presented by Thos. Keate, Esq.*

𝔄 41. A small, very regularly-shaped oval calculus, similar in structure and composition to the preceding specimen. *British Museum.*

𝔄 42. A mass of vegetable fibre, surrounded by a layer of diphosphate of lime. *Hunterian.*

𝔄 43. An oval calculus, consisting almost entirely of diphosphate of lime, having a piece of slate for its nucleus. *Hunterian.*

𝔄 44. A small irregularly-shaped calculus, composed of diphosphate of lime.
Presented by Thos. Keate, Esq.

𝔄 45. A section of an irregularly-shaped diphosphate of lime calculus, having an eccentric nucleus. *Mus. Leverian.*

𝔄 46. An irregularly-shaped diphosphate of lime calculus. Described in the Sloanian MS. Catalogue as an "Occidental or West Indian Bezoar, conglomerated, many small ones together. From Mr. Vantruffe."
British Museum.

𝔄 47. A similar specimen to the preceding, also described as an Occidental Bezoar. *British Museum.*

𝔄 48. A diphosphate of lime calculus, having the form of a three-sided prism.
British Museum.

𝔄 49. Several small calculi, composed of diphosphate of lime. "Buenos Ayres Bezoars." *British Museum.*

𝔄 50. Half of a large oblong calculus, broken transversely. *Hunterian.*

𝔄 51. Fragments of a diphosphate of lime calculus, which encrusted a mango-seed, portions of which still remain. *British Museum.*

𝔄 52. An oval calculus, consisting principally of diphosphate of lime, which has been deposited upon apparently pieces of leather. *Leverian Museum.*

𝔄 53. A large irregularly-shaped calculus, composed of diphosphate of lime. *Leverian Museum.*

𝔄 54. A small calculus. Described in the Sloanian MS. Catalogue as "A Bezoar within a pouch." It is composed of diphosphate of lime, and has been preserved in the pouch which forms the nest of the *Aranea Avicularia.* *British Museum.*

𝔄 55. A portion of a diphosphate of lime calculus, the layers of which exhibit a pseudo-metallic lustre. Vide PlateXV. fig. 4. *British Museum.*

𝔄 56. Some small irregularly-shaped phosphate of lime calculi. "Occidental Bezoars."—*Sloanian MS. Catalogue.* *British Museum.*

𝔄 57. An egg-shaped hollow calculus, from the alimentary canal of a Deer. It is composed of diphosphate of lime which has been deposited upon the acorn of the *Quercus Ægilops.* *Presented by John Abernethy, Esq.*

𝔄 58. An elongated oval bezoar, taken from a species of antelope. Cape of Good Hope. It consists of diphosphate of lime, surrounding a small fragment of flint. *Presented by Dr. Stanger,* 1845.

CALCULI CONSISTING PRINCIPALLY OF OXALATE OF LIME.

Concretions evidently of intestinal origin have been discovered in this Collection, composed either of pure oxalate of lime or of oxalate mixed with carbonate of lime. This fact, which was announced in the first part of this Cata-

logue, published in 1842, has since been confirmed by M. Guibourt in a paper read before the Academy of Sciences at Paris in 1843.

Oxalate of lime calculi resemble all other concretions in possessing a laminated structure; their texture however is so dense and compact that the concentric layers cannot be separated from each other. They do not possess the radiated crystalline structure of phosphate of lime or triple phosphate concretions, although they have an indistinct appearance of lines radiating from the centre. Their exterior is usually crystalline, but does not put on the irregular tuberculated appearance characteristic of the concretions from the urinary bladder. They are generally of a globular or oval figure, and both within and without are of a light yellow or dirty white colour. The above characters apply more particularly to the concretions consisting of pure oxalate of lime. Those which contain carbonate of lime are less regularly laminated and much looser in texture. Vide Plate XV. figs. 1, 2, 3.

The composition of these concretions is shown by the following analysis of a very pure specimen in this Collection. 37·40 grains, when dried at a temperature of 240° Fahr., lost 2·06 of water. The dried powder was digested in strong acetic acid, which acquired a yellow colour, but no apparent solution took place. The acid liquor gave no precipitate with ammonia, and only a faint precipitate with oxalate of ammonia; being evaporated to dryness a small quantity of sulphate of lime was left behind. The insoluble residue dissolved entirely in nitric acid with a bright yellow colour, and a copious white precipitate was thrown down by the addition of ammonia. The precipitate was digested while moist with concentrated acetic acid, and collected upon a filter; when dry it weighed 35·25 grains. The greater part of this precipitate was boiled for a considerable time with a dilute solution of carbonate of potass, the liquid filtered, and to the clear solution nitrate of lead was added; a copious precipitate of oxalate and carbonate of lead was thrown down, which, after repeated washings, was diffused through water and decomposed by sulphuretted hydrogen. The liquor, when freed from sulphuret of lead, yielded on evaporation long prismatic crystals of oxalic acid. Another portion of the precipitate being calcined in a platina crucible, left a residue consisting wholly of carbonate of lime.

Hence this calculus consists of 94·25 per cent. of oxalate of lime, 5·50 water, and 0·25 sulphate of lime. Another concretion was found to consist of oxalate

of lime with a minute quantity of yellow colouring, and animal matter 66·48, carbonate of lime 29·27, water 2·95, phosphate of lime with a trace of peroxide of iron 1·30.

It is probable that these concretions are formed from the oxalate of lime or alkaline oxalates contained in many plants. All the concretions in the Museum have a nucleus of vegetable fibre which was submitted to microscopic examination by Dr. F. Farre, but without his being enabled to recognise the plant from which it was derived. In the Sloanian MS. Catalogue these concretions are termed Elephant Bezoars, and it is not improbable that some of them were taken from that animal.

W. *Oxalate of Lime.*

W 1. "An Elephant Bezoar."—*Sloanian MS. Catalogue.* This concretion is of a flattened globular figure, and measures nearly five inches in diameter. Its exterior has been polished. It consists per cent. of oxalate of lime 94·25, water 5·50, sulphate of lime 0·25. The nucleus is formed by a mass of vegetable fibre. *British Museum.*

W 2. A concretion similar in composition and figure to the preceding specimen, but smaller. Its exterior is crystalline, and its nucleus consists of undigested vegetable fibre and hairs. Vide Plate XV. fig. 3. *British Museum.*

W 3. A section of an oxalate of lime concretion, which measures four inches in diameter, and has a nucleus of vegetable fibre. Its exterior is crystalline. "An Elephant's Bezoar."—*Sloanian MS. Catalogue.* *British Museum.*

W 4. A small oval calculus, the surface of which is studded with the summits of crystals apparently of a rhombic figure. This calculus was arranged by Mr. Hunter among the human urinary concretions, but its having a nucleus of vegetable fibre shows that it is a Bezoar. It consists of nearly pure oxalate of lime. Vide Plate XV. figs. 1, 2. *Hunterian.*

W 5. A large oblong concretion surrounding a mass of vegetable fibre. It

consists per cent. of oxalate of lime 66·48, carbonate of lime 29·27, water 2·95, phosphate of lime, with a trace of peroxide of iron, 1·30. It is less regularly laminated, and much less compact in texture than the preceding specimens. *British Museum.*

AMBERGRIS. THE CONCRETE MATTER FOUND IN THE ALIMENTARY CANAL OF THE SPERMACETI WHALE.

This substance is usually found floating on the sea near the coasts of India Africa, and South America. It is in the form of amorphous masses, having a peculiar odour, soft and unctuous to the touch, and of a greyish black colour, mottled with greenish white or brown spots. A great variety of opinions have been entertained as to the origin of ambergris. It is however now well ascertained that it is a morbid product formed in the intestines of the Spermaceti Whale, *Physeter macrocephalus.*

Ambergris consists principally of an inodorous crystalline fatty matter, termed Ambrein, mixed with a yellow oil and a small quantity of extractive matter containing benzoic acid and chloride of sodium. The horny beaks of the Squid, *Sepia moschata*, on which the Sperm Whale feeds, are often found imbedded in its substance, and it is supposed that its peculiar odour is derived from the Squid.

Ambrein resembles cholesterine in all its principal chemical characters. It is not saponified when acted upon by alkalies, is readily soluble in alcohol and ether, and yields a peculiar acid, termed *Ambreic acid*, by the action of nitric acid. The proportions of its ultimate constituents are also nearly the same as those of cholesterine.

By most writers of the present day ambergris is considered to be the fæces of the Whale altered by disease. Mr. F. D. Bennett says that "it is a morbid concretion in the intestines of the Cachalot, deriving its origin either from the stomach or biliary ducts, and allied in its nature to gall-stones or to the bezoars of herbivorous animals; while the masses found floating on the sea are those that have been voided by the Whales, orliberated from the dead animal by the process of putrefaction *.

* Narrative of a Whaling Voyage round the Globe, 1840.

The great analogy which ambrein bears to cholesterine would however incline us to the opinion that it is a product of the biliary organs, in which case it would be properly classed among biliary concretions.

𝔛. *Ambergris.*

𝔛 1. A section of a large rounded mass of ambergris, having an indistinct lamellar structure. ***Hunterian.***

𝔛 2. A similar but smaller mass divided. ***Hunterian.***

𝔛 3. A small portion of ambergris. ***Hunterian.***

𝔛 4. A portion of ambergris superior in quality to the preceding specimens. ***Purchased,*** 1845.

PART III.

THE concretions described in this part of the Catalogue comprehend those unorganized substances found in the joints, veins, bronchi, lachrymal ducts or other parts of the living body which could not be included in the two former parts of the Catalogue. Concretions of this class rarely possess a laminated character or any definite structure, and, with the exception of the gout-concretion, they invariably consist of phosphate with carbonate of lime.

Division I.

CONCRETIONS FROM THE LACHRYMAL DUCT OF MAN.

These concretions are not of very common occurrence. According to Fourcroy they consist of phosphate aud carbonate of lime. There are no specimens of the kind in the Museum.

CONCRETIONS FROM THE LUNGS OR BRONCHI OF MAN.

Pulmonary concretions are generally composed of phosphate and carbonate of lime, with a large quantity of a dense membranous matter. Dr. Henry found one of these concretions to contain 20 per cent. of phosphate of magnesia and ammonia *.

* Thomson's Ann. 15, 116.

β. 1. A stone spit out of a woman's lungs. From Dr. Grew's Collection.—*Sloanian MS. Catalogue.* Phosphate and carbonate of lime.
British Museum.

CONCRETIONS FROM THE JOINTS, ETC. OF MAN.

The composition of gout or chalk-stones was first determined by Dr. Wollaston in 1797, who found them to consist of suburate of soda. Many of these concretions contain a large quantity of phosphate and carbonate of lime, and in some cases these earthy salts form the principal constituent.

Gout Concretions.

γ 1. Small masses of urate of soda. *Hunterian.*

γ 2. A mass of phosphate of lime with carbonate of lime and some urate of soda, surrounded by a thick membranous coat. "Bunner's gout-stones."—*Hunterian MS.* *Hunterian.*

γ 3. A small mass of urate of soda from a gouty patient.
Presented by Anthony White, Esq., 1836.

γ 4. The first phalanx of the bones of the great toe, on the upper surface of which is a mass of gouty deposit, consisting of urate of soda mixed with a large quantity of phosphate of lime. *Museum Heaviside.*

CONCRETIONS FROM THE VEINS OF MAN, *Phlebolites.*

Concretions from the veins are invariably composed of phosphate and carbonate of lime. They are of very common occurrence, but there are no specimens in the Museum.

Division II.

There are no specimens in the Museum of concretions from the lungs, lachrymal duct or veins of the lower animals.

CASTS OF CALCULI.

1. A coloured cast of a large and very irregularly formed calculus.

Hunterian.

"The stone, of which this is the exact model in plaster of Paris, was extracted from a gentleman aged 86, after having been most grievously afflicted with it during twenty years. The concavity No. 1 was formed upon a scirrhous tumour situated internally upon the left side of the neck of the bladder, and which an assistant with his fingers depressed during the operation, in order to facilitate the extraction, which was rendered extremely difficult, not so much on this account, or of the stone's bulk, but its irregular shape, and the face No. 1 presenting to the orifice. The protuberance No. 3 was, immediately upon the extraction, from the dotted lines to its apex, of a flesh-colour, as if drawn out of a cavity in the bladder; into which the tumour situated at its neck, by gradually increasing, had formed the cup No. 1, and most certainly thrust it. The numbers 2. 2. are where the forceps laid hold, and on one side a scale is broken off by them at No. 4.

"The gentleman survived the operation but a few hours.

"P.S. My friend Mr. Todd, who opened the body, wrote me that 'he found the bladder much contracted, its coats thickened and become almost scirrhous; and the tumour, which seemed to retard the extraction of the stone, was scirrhous, about the size of a common egg, and something of the kidney shape, seated in the posterior part, and close to the neck of the bladder, contiguous to, and on the left side of the prostate gland, which appeared sound, and of its natural size:—the basis of the stone resting upon the tumour, and its point evidently attached to the

superior part of the bladder, fixed it, as it were, at both ends; which, together with the irregular and uncommon form of the stone, makes one not wonder at the difficulties encountered in fixing the forceps as well as in extracting the stone.'"

2. "A plaster of Paris cast, of an extraordinary calculus, taken from the urinary bladder of Mr. Charles Noble of Canterbury after death. A piece has been broken off from one end, which corresponded to the neck of the bladder; it is said to have weighed seventeen ounces when first taken from the patient. About a teacupful of small calculi were taken out at the same time. See Gentleman's Magazine, 1785."

Hunterian.

3. Four casts of vesical calculi. *Hunterian.*

4. A coloured cast of a very large calculus from the human urinary bladder. It measures 15 inches in its greatest circumference and 11·7 in its least. According to the analysis of Professor Cumming, it consists principally of uric acid deposited upon an oxalate of lime concretion having a small nucleus of uric acid, its exterior being coated with a thin crust of the fusible calculus. The calculus is preserved in the Museum of Trinity College, Cambridge. *Presented by the Rev. J. Cumming,* 1823.

THE END.

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PLATE XIII.

Fig. 1. Represents the exterior of a carbonate of lime calculus, from the urinary bladder of the Hog. V 3, p. 152.

Fig. 2. Represents the interior of the same calculus.

Fig. 3. Represents the section of a calculus, taken from the ureter of the Sturgeon, *Acipenser Huso*, Linn. These concretions were formerly termed Beluga stones. They are composed of 1 equiv of diphosphate of lime with 5 eqs. of water. R 1, p. 147.

Fig. 4. Represents the smooth polished exterior of some small carbonate of lime calculi from the urinary bladder of the Ox.

Fig. 5. Represents the exterior of three small calculi from the Ox. They are similar in composition to the preceding, but their exterior is rough and tuberculated. V 30, p. 156.

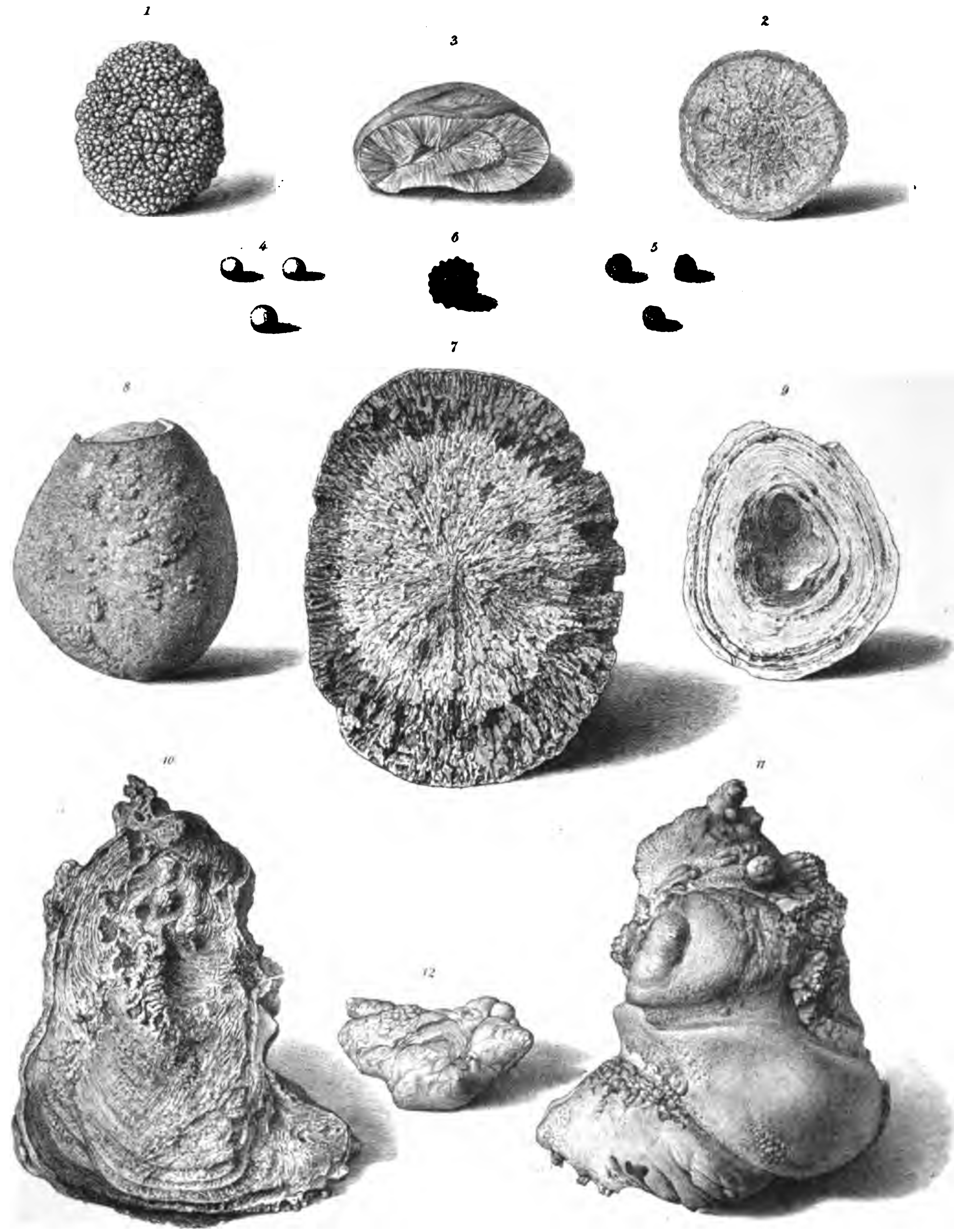
Fig. 6. Represents a small oxalate of lime calculus, from the ureter of a Hog. Q 1, p. 143.

Fig. 7. Represents the section of a urinary calculus composed of carbonate of lime, which was voided by a mare. V 11, p. 154.

Figs. 8, 9. Represent the exterior and interior of the urate of potass calculus. From the bladder of a species of Iguana. P 6, p. 141.

Figs. 10, 11. Represent the exterior and the section of the ordinary renal calculi from the Horse. They consist principally of carbonate of lime. V 4, p. 152.

Fig. 12. Exhibits the smooth shining surface which the carbonate of lime calculi from the kidney of the Ox usually possess. V 22, p. 155.



From Nature on Zinc by Lens Aldous.

PLATE XIV.

Fig. 1. Exhibits the crystalline structure which the broken surface of the triple phosphate calculus from the alimentary canal of the Horse usually presents.

Fig. 2. Represents the section of a similar calculus divided by the saw, in which the laminated structure is most apparent. The centre of this calculus consists of large crystals of triple phosphate. 𝕾 62, p. 247.

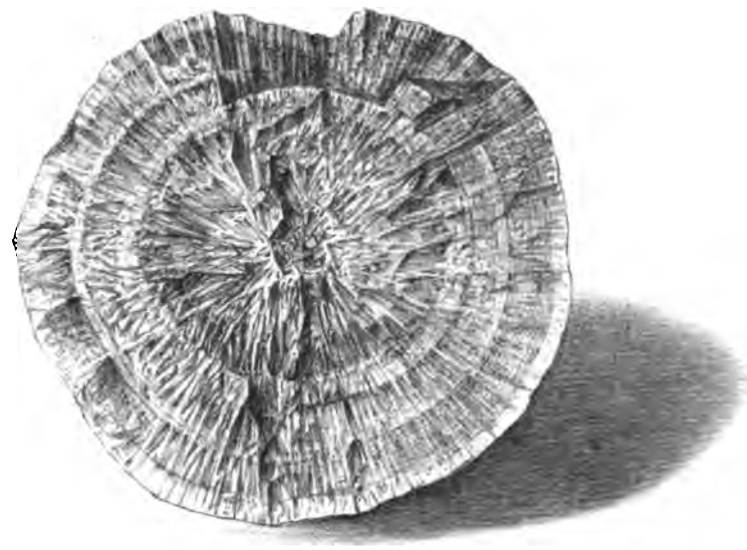
Fig. 3. Represents the section of an intestinal concretion, consisting of diphosphate of magnesia. 𝕿 2, p. 250.

Fig. 4. Represents the scaly tuberculated exterior, characteristic of diphosphate of magnesia calculi. 𝕿 14, p. 251.

Fig. 5. Represents a fragment of a diphosphate of magnesia calculus, showing the reticulated deposit of phosphate of lime which is usually found between their layers.

Plate 14.

1



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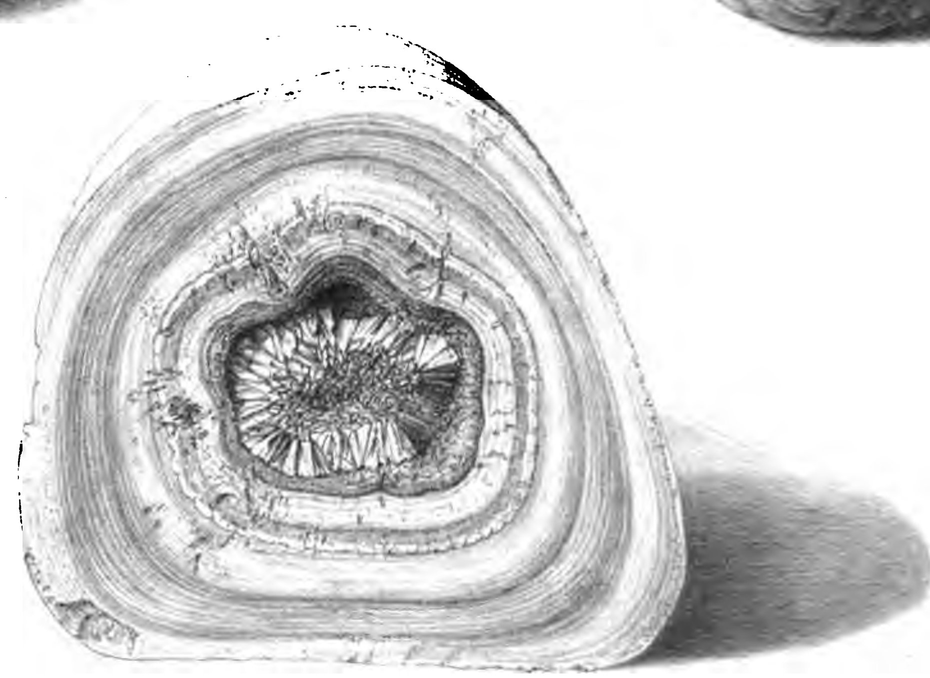

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PLATE XV.

Fig. 1. Represents the section of an intestinal calculus, composed of nearly pure oxalate of lime. 𝔄𝔄 4, p. 260.

Fig. 2. Exhibits the crystalline exterior of the same calculus.

Fig. 3. Represents the section of an oxalate of lime calculus, having a nucleus of vegetable fibre. 𝔄𝔄 2, p. 260.

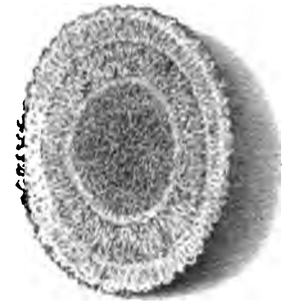
Fig. 4. Represents the broken surface of a small diphosphate of lime calculus, showing the pseudo metallic lustre which its layers occasionally present. 𝔄 55, p. 258.

Fig. 5. Represents the section of a large diphosphate of lime calculus, which exhibits in a marked manner the laminated and radiated structure characteristic of this species of intestinal calculus. 𝔄 2, p. 253.

Fig. 6. Represents the external surface of the same calculus.

Plate 15.

1



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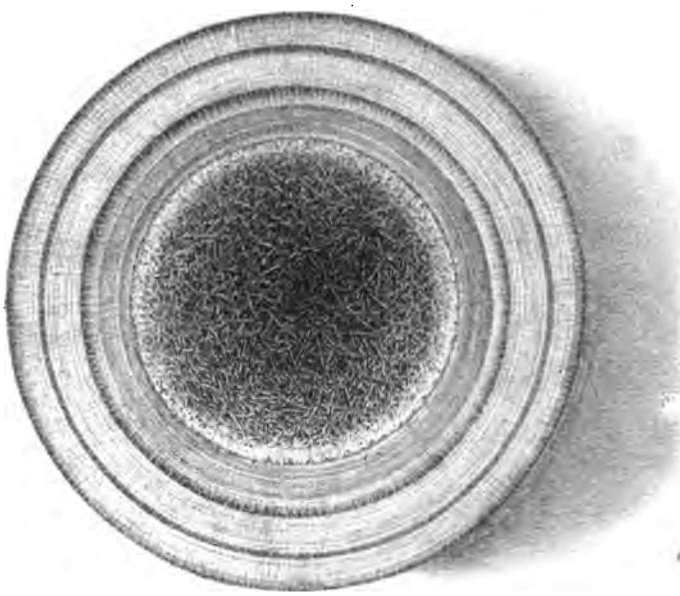

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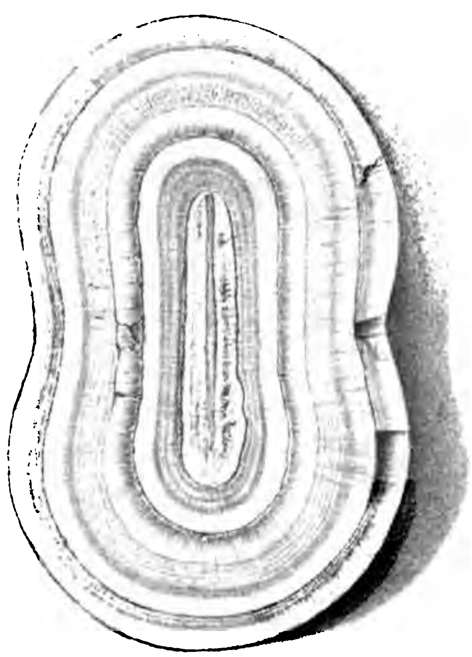

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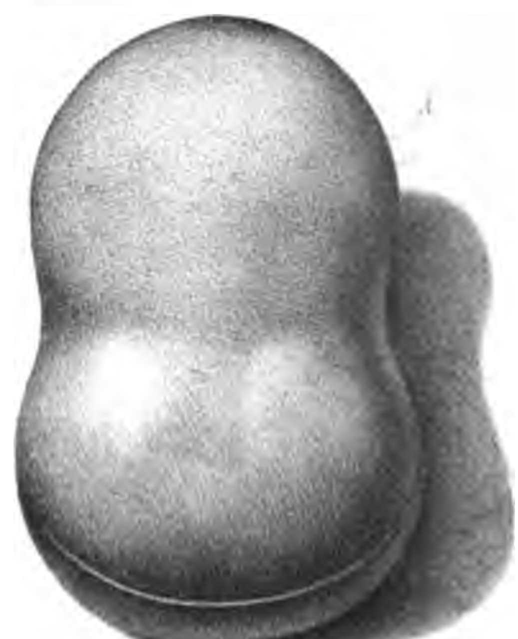

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PLATE XVI.

Figs. 1, 2. Represent the exterior and a section of an Oriental Bezoar, described in this Catalogue as consisting of ellagic acid. The nucleus consists of the capsule of some seed. 𝕼 2, p. 232.

Fig. 3. Represents the ***Pedra Bugia*** or Ape-stone, also composed of ellagic acid, and having a piece of twig in its centre. 𝕼 18, p. 233.

Fig. 4. Represents the half of a hair-ball, coated by a thin earthy crust. From the intestine of a Cow. 𝕺 16, p. 218.

Fig. 5. Represents the exterior of an uncoated hair-ball, from the Cow. This figure shows the regular manner in which the hairs are arranged around the long axis of the calculus, owing to the peristaltic action of the intestines. 𝕺 1, p. 217.

Fig. 6. Represents the section of an oat-hair concretion from the intestine of the human subject. *a* is an oat-seed slightly magnified, showing the small setæ on its summit, of which the oat-hair concretions are composed. *c*, *b*, *d*, *e* are highly magnified views of the setæ of the oat-seed. The diameter of the central tube of *b*, *c* is much smaller than that of *d* and *e*. From a drawing by Dr. J. W. Griffith. 𝕴 1, p. 195.

Fig. 7. Represents the ordinary appearance of the exterior of a resino-bezoardic acid calculus (***Lithofellinic acid***, Goëbel). These concretions are described in this Catalogue as consisting of a vegetable resin derived from the juices of the plants on which the goats of Persia and South America have fed. 𝕽. p, 238.

Fig. 8. Represents the section of the same calculus.

Fig. 9. Represents a fragment of a resino-bezoardic acid calculus. 𝕽 20, p. 240.

Plate 16.

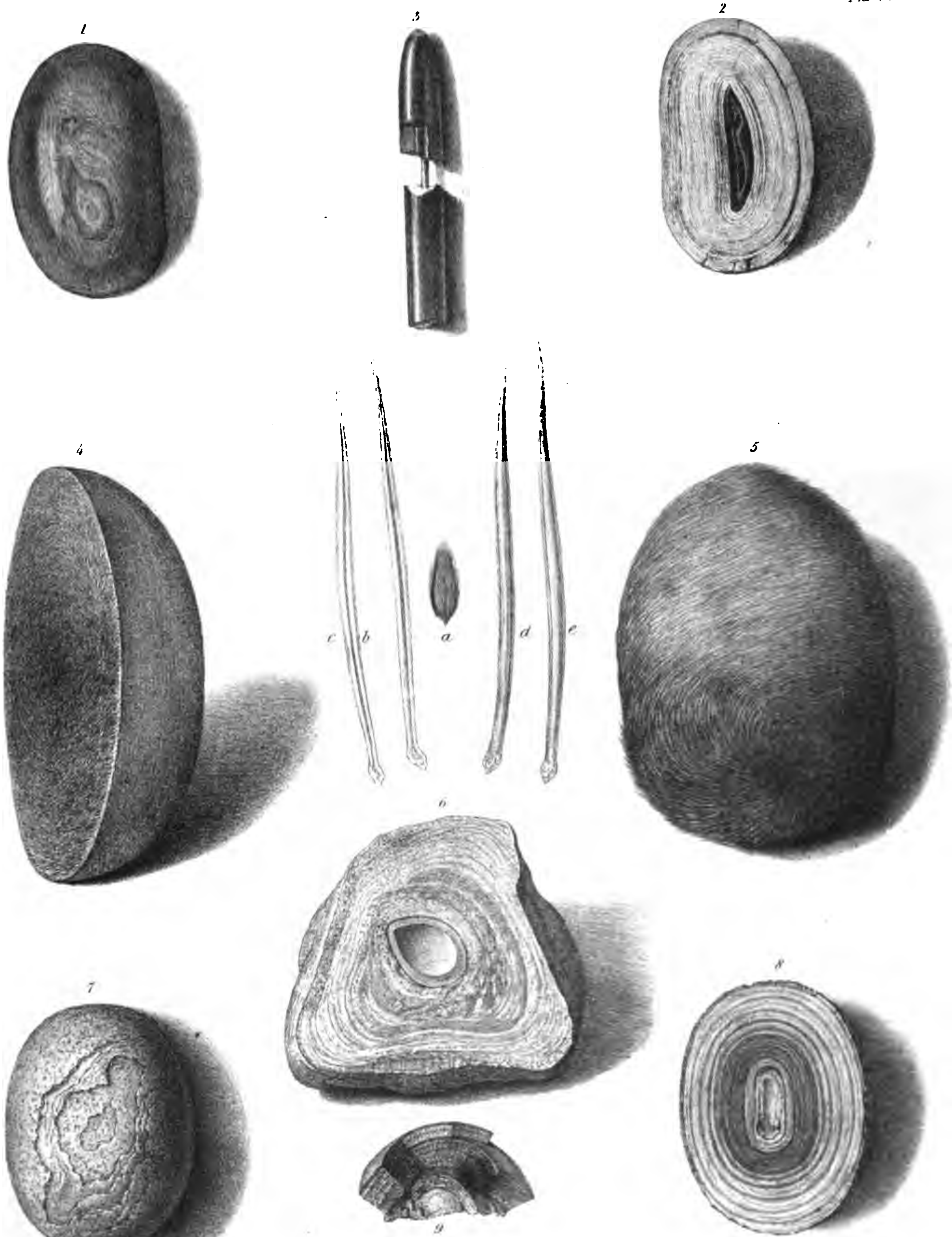

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PLATE XVII.

Fig. 1. Exhibits the section of the stearate of lime calculus described at page 187. From the gall-bladder.

Figs. 2, 3, 4, 5. Are representations of the ordinary biliary calculi from Man, composed of cholesterine, mixed with the colouring matter of the bile.

Fig. 6. Represents the section of a triple phosphate calculus from the urinary bladder of a Whale. S 5, p. 148.

Fig. 7. Represents a salivary concretion from the sublingual duct of the human subject. 𝕲 4, p. 191.

Fig. 8. Represents the half of a large biliary calculus, voided per anum. Its centre consists of pure cholesterine, its outer layers of cholesterine and the colouring matter of the bile. 𝔄 4, p. 168.

Figs. 9, 10, 11. Are highly magnified views of the vegetable hairs, of which the concretions described at pages 224, 225 are principally composed.

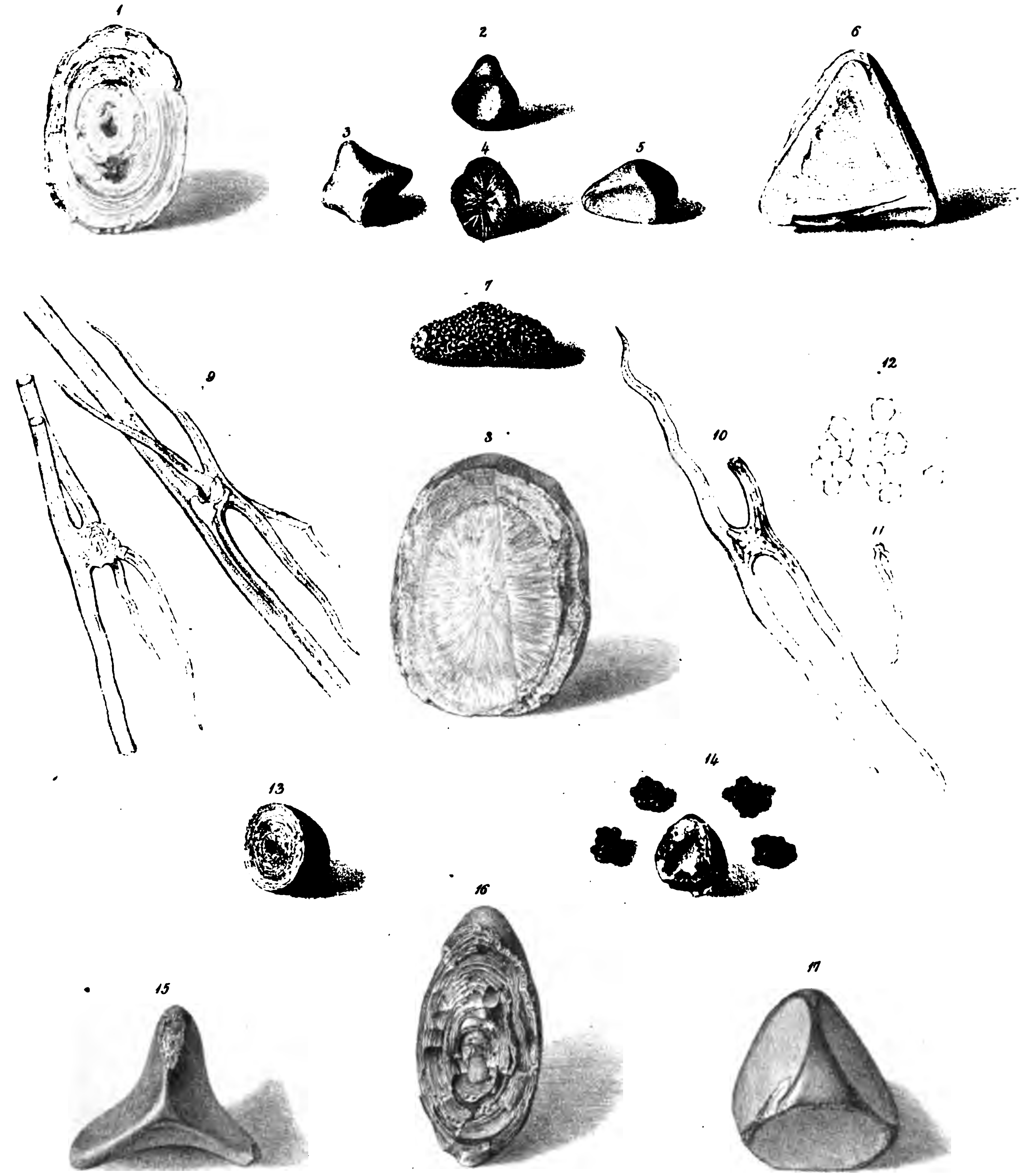
Fig. 12. Represents a group of small six-sided plates of resino-bezoardic acid, produced by the cooling of the fused resin.

Fig. 13. Represents a section of a carbonate of lime calculus from the gall-bladder. 𝕯 1, p. 190.

Fig. 14. Represents the biliary calculi described at page 183. 𝕭 β 1 and 2.

Figs. 15, 16, 17. Represent three different forms of biliary calculi from the Ox. Colouring matter of the bile. 𝕸 2, 3, pp. 202, 203.

Plate 17.



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